FLIGHT

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The Outlook

"Overflowing Reserves"

NOT the least heartening of the references to the progress of the air war which Mr. Churchill made in his review of the situation on August 20 was that in which he referred to the subject of production. After mentioning the salvage system by which damaged aircraft are repaired and returned to the fighting line, Mr. Churchill paid a tribute to the output of aircraft and engines which, under the drive of Lord Beaverbrook, "looked like magic"; the Prime Minister said that this had given us an overflowing reserve of every type of aircraft. Our new production, he was advised, already largely exceeded that of the enemy, and American production was only just beginning to flow in.

"It is a fact," Mr. Churchill continued, "as I see from our daily returns, that our fighter and bomber strengths are now, after all this fighting, larger than they have ever been."

The Prime Minister is certainly not likely to underrate German production. When he was a voice crying in the wilderness he warned the Baldwin and Ramsay MacDonald self-complacent Governments of Germany's tremendous efforts to build up her air force. He is not likely to be one degree less concerned about German production now, and if he can tell the House of Commons that our production has overtaken that of Germany, we may be sure that Mr. Churchill has good grounds for his statement. Let us examine what it implies.

Profit and Loss Account

SPECULATIONS about the rate of German aircraft production vary. Mr. T. P. Wright, of the Curtiss-Wright Corporation, a very knowledgeable authority, has given it as his opinion that the figure is 2,000 machines a month. Other authorities have thought 1,800 more likely. Our Air Ministry considers even the lower figure an over-estimate. Let us, for the purpose of argument, take 65 machines a day as likely to be not far wrong. Some of these must be trainers, perhaps 15 will be, leaving 50 operational machines coming out of the German factories every day.

In the recent mass attacks on Britain the most intensive period was the eight days from August 11 to August 18, both inclusive. There was fighting on only seven of those days, for Saturday the 18th was a blank. If our estimated figures are to be accepted, in those eight days the *Luftwaffe* received from the factories 400 operational machines. In those eight days our defences destroyed for certain 644 fighters and bombers. That shows a substantial margin of loss over gain to the *Luftwaffe*. It even allows a margin for error in our figures, and still means that we were shooting down German machines faster than their factories could turn them out.

That does not necessarily mean that Göring has accepted a defeat in his air campaign against Britain. He must have large reserves. But the figures do not suggest that the air war is likely to end in a German success.

WAR CABINET CONGRATULATES BOMBER SQUADRONS

The Secretary of State for Air has received the following message from the Prime Minister:—

"Please convey to the Commander-in-Chief, Bomber Command, the congratulations of the War Cabinet on the success of the operations against Germany on Friday night. The War Cabinet is impressed by the skill with which both these operations and those against Italy and Germany on other recent occasions have been prepared, and by the cool and sure courage and efficiency with which the fighting crews of the bomber squadrons have carried them out. Both the night and the day bomber squadrons are dealing hard blows against Italy and Germany and they deserve the thanks and admiration of their fellow-countrymen"

A Year of War

IT is rather hard to realise that September 3 marks the anniversary of the outbreak of war. No war, it has been said, is ever quite like the last, and the truth of that saying comes home to us when we consider the differences between 1914 and 1939-40. That one year should have witnessed the overrunning of nearly all Europe by the Germans would have sounded incredible if some Old Moore had foretold it a year ago. In 1914 the Royal Flying Corps was just trying to find itself, conscious that a great future lay before it, but still uncertain of its powers and possibilities. Now, apart from the sleepless blockade by the Royal Navy, the Royal Air Force is the only arm with which we can actively hit the enemy. It is also the only arm with which we can repel the enemy's efforts to discommode us.

How wonderfully complete is the present Royal Air Force compared with the rudimentary R.F.C. of 1914! No longer is it groping and feeling its way. Splendidly manned, splendidly equipped, with twenty-five years of training behind it, guided by an experienced and sagacious staff, the Force is confidence personified. On another page a pilot of the Bomber Command tells of the confident spirit with which the squadrons of that body set forth night after night to find and destroy the resources of the enemy.

Our fighter pilots, too, have surpassed all the high hopes which we had entertained of them. If the German bombers will only come in sufficient numbers, they destroy their machines faster than the factories can turn them out. As the Prime Minister said, "Never in the field of human conflict was so much owed by so many to so few."

The Air Over the Sea

THE Bomber and Fighter Commands had to wait for what seemed to them long, weary months before they could use their full powers against the enemy. But from the first day of war up to the present, and no doubt for all the remaining months or years of the war, the Coastal Command has been going, so to speak, full throttle ahead. Until the war spread to the Low Countries and France, the Coastal Command pretty well absorbed all the air interest of the war. It was then a maritime war, and the Coastal Command's chief function is reconnaissance for the Royal Navy.

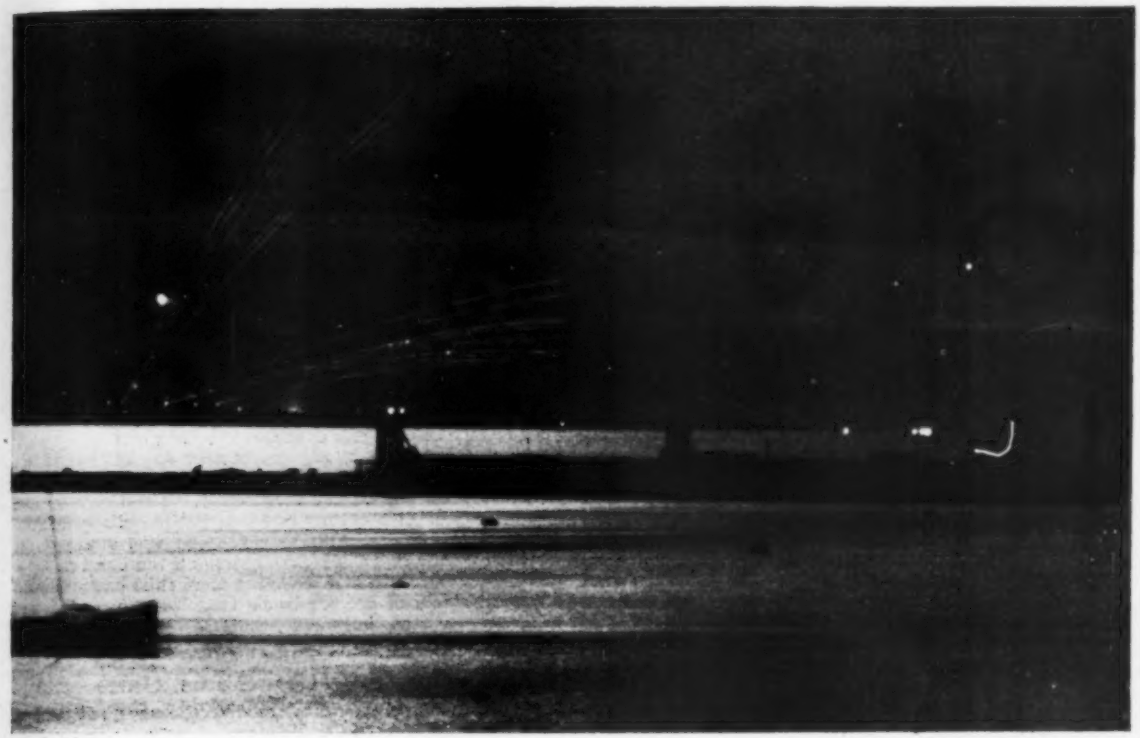
In these anniversary reminiscences we must not forget the Fleet Air Arm. It has only had a separate existence since 1937, and it might easily be equipped with more suitable types of aircraft. None the less, it has done splendidly. Some of its dive-bombing and torpedo-dropping attacks have been magnificent feats. The Admiralty has sent a signal to say "We are proud of the Fleet Air Arm." The whole country will associate itself with that message.

FROM ME TO YOU

Air Chief Marshal Sir Hugh Dowding and pilots of the Fighter Command have presented Lord Beaverbrook with this nice heap of scrap metal from destroyed German machines for aircraft production. In the period August 11 to August 18 645 enemy machines were brought down in or round Britain.

WAR in the AIR

The Prime Minister's Speech : Another Victoria Cross : Italians Heavily Bombed



IN SORRY STRAITS. A picture taken during a Royal Air Force attack on the German-occupied coast between Calais and Boulogne. On the left are seen "flaming onions" and other shells bursting in the sky, while at ground level is to be seen the glow of a fire started by bombs. This picture was taken on the South East coast of England.

THE Prime Minister, Mr. Winston Churchill, made a striking speech in the House of Commons on Wednesday, August 21, reviewing the present position. In the course of it he made the following most heartening announcement: "The enemy is, of course, far more numerous than we are, but our new production already, as I am advised, largely exceeds his, and American production is only just beginning to flow in. It is a fact that after all this fighting our bomber and fighter strengths are larger than they have ever been."

Among other striking passages in Mr. Churchill's speech were the following: "We must certainly expect that greater efforts will be made by the enemy than any he has so far put forth. It is quite plain that Herr Hitler could not admit defeat in his air attack on Great Britain without sustaining most serious injury. If his whole air onslaught were forced tamely to peter out the Führer's reputation for veracity of statement might be seriously impugned." Mr. Churchill also spoke of "any preoccupations he (Hitler) may have in respect of the Russian Air Force," a cryptic saying which he did not elaborate.

Of our fighter pilots Mr. Churchill said: "The gratitude of every home in our island, in our Empire, and indeed throughout the world, except in the abodes of the guilty, goes out to the British airmen, who, undaunted by odds, unwearied by their constant challenge and mortal danger, are turning the tide of world war by their prowess and by their devotion. Never in the field of human conflict was so much owed by so many to so few."

Then, turning to the bomber squadrons, he added: "We must never forget that all the time, night after night, month after month, our bomber squadrons travel far into Germany, find their targets in the darkness by the highest navigational skill, aim their attacks, often under the heaviest fire, often at serious loss, with deliberate, careful precision, and inflict shattering blows upon the whole of the technical and war-making structure of the Nazi power. On no part of the Royal Air Force does the weight of the war fall more heavily than on the daylight bombers, who will play an invaluable part in the case of invasion and whose unflinching zeal it has been necessary in the meantime on numerous occasions to restrain."

The Prime Minister added that our bombing efforts "May in another year attain dimensions hitherto undreamed of," and that they "assured one of the most certain if not the shortest of all roads to victory."

Another Victoria Cross

THE splendid attack by Hampden bombers on the Dortmund-Ems canal on August 12 will be remembered. For his part in the raid Acting Flight Lieut. R. A. B. Learoyd was awarded the Victoria Cross. He was the third member of the R.A.F. to receive this most glorious of all distinctions in the present war. On Monday, August 19, he was brought to the microphone of the B.B.C. and gave a modest account of the raid. "It was unfortunate," he said, "from our point of view of course, that the enemy knew pretty well the direction from which we must attack. They had disposed their defences so that they formed a sort of lane through which we had to pass. It seemed to me that they had strengthened these defences a great deal since the first raids." His starboard wing was hit twice

WAR IN THE AIR (CONTINUED)

IN FULL WAR PAINT. A formation of Boulton Paul Defiant fighters above the clouds. These two-seater fighters have already given a good account of themselves. In one action alone a squadron bagged thirty-seven German aircraft.

by shells, and the hydraulic system was damaged, but he flew round about till dawn and then landed his Hampden without damage.

In our last issue we recorded that on Sunday, August 18, the enemy losses over and around Britain were 140 machines. Subsequent reports brought the total for that day up to 152, of which 23 were shot down by fire from the ground. We lost 22 machines that day, but 12 of our pilots were safe. One loss on each side that day was caused by a collision, possibly a deliberate ramming of a Heinkel by a sergeant pilot who was completing his final course at a F.T.S. He was flying solo in an unarmed Anson by night when the Heinkel appeared and dropped bombs. It then fired with a machine gun at the Anson, and it seemed that the sergeant deliberately rammed the bomber, thus sacrificing his own life and killing the German crew.

Talking of unusual combats, an example of chivalry which is rare in modern war had been given a few days before. A Hudson aircraft of the Coastal Command on patrol near Borkum saw something reflected on the water in the moonlight. The pilot went down, and found a Heinkel seaplane resting on the sea. The German in that position would have been easy prey for the Hudson. The British crew, however, thought it unsporting to attack a "sitting bird." So the Hudson rose and twice dived on the Heinkel with its powerful headlights on. The German accepted this invitation to come into the air and fight. The first burst from the Hudson's front guns tore strips of burning fabric from the Heinkel, the cockpit of which was lit up by the glow of British tracer bullets. The German seaplane tried desperately to avoid further attack and to reach the Dutch coast. In its efforts to escape it flew only a few feet above the sea. But it could not get away from the Hudson which, after twenty minutes' pursuit, forced it down in the sea with short-range machine gun fire. The Heinkel burst into flames and sank.

Varying Enemy Activity

THE most intense period of air fighting was from Sunday, August 11, to Sunday, August 18. In those eight days (actually they were seven days, as Saturday the 17th was a blank) our aeroplanes and ground fire destroyed 644 German machines. During the same period we lost 137 machines, but 58 of the pilots were safe.

The French Air Ministry at Vichy has recently announced that the French Air Force had destroyed 982 German machines in the month which ended on June 10. It stated that its own loss in men was 589, or 29 per cent. of the fighting effectives.

On *Monday, August* 19, the German raids over Britain were made by a few aircraft flying alone. Five were shot down, and we lost three machines, but the pilots of two were safe. A number of people were killed and injured in various parts of the country.

On that day our bombers were active by daylight, and still more so during the night. Kiel dockyard was attacked again, and several other important places in Germany. Blenheims of the Coastal Command raided the aerodrome at St. Omer—the headquarters of the R.F.C. in the last war.

Tuesday, August 20, was another day of only slight enemy activity. A.A. gunners on the N.E. coast saw a three-engined flying boat, identified as a Dornier 24, caught in searchlight beams, and shot it down into the sea.

Polish pilots in this country, who had previously been distributed among various British fighter squadrons, have now been formed into one squadron, with a British C.O. This squadron was in action on that day and scored its first victory by shooting down a Junkers 88. The A.O.C. of the Group to which it belongs sent the squadron a signal in Polish, congratulating it on its success. The enemy lost eight machines that day, while two of ours were shot down, but only one pilot was lost.

The weather was too bad for our bombers to visit Germany that night, but during the day we raided aerodromes in enemy-occupied territory, and machines of the Coastal Command attacked two German destroyers in the North Sea, and damaged one of them.

Wednesday, August 21, was another day of tip-and-run tactics by the Germans. Some casualties were caused in an attack on one of our aerodromes. The Germans lost 13 machines. One of ours was lost, but the pilot was safe.

A Hudson of the Coastal Command was attacked for 35 minutes by seven Me 109 fighters off the coast of Denmark, but survived after shooting one of the enemy down. Two members of the Hudson's crew were wounded and the machine was shot about, but certainly the honours of the action did not go to the fighters.

Bombing the Calais Guns

A NEW feature was introduced into the war on *Thursday, August* 22, when the big guns which the Germans have mounted in the Calais area round Cape Gris Nez shelled Dover. The distance is 21 or 22 miles. Some property was damaged and there were some casualties. R.A.F. bombers soon got busy on the emplacements, and repeated their attacks on subsequent nights.

Raiding on Britain was on a small scale both by day and by night, but attacks were made on London suburbs. Again some damage was done, notably to two cinema buildings, and there were casualties. In these suburbs and in other towns the streets were machine-gunned. We shot down 10 raiders for a loss of two fighters, but the pilot of one was safe.

We sent Coastal Blenheims to St. Omer aerodrome that night, and one of them bombed the flare path as a German machine was about to land.

The Middle East bombers had a good day. They raided Bomba roadstead in Libya and bombed four Italian warships, two submarines, a destroyer, and a depot ship.

Slight scattered raiding continued on *Friday, August* 23. A Midland Spa was bombed and machine-gunned. We bombed 20 aerodromes and seaplane bases in France and Holland during the day and lost three bombers in the process. During the night we attacked the military aerodrome at Villacoublay on the outskirts of Paris, and one of our bombers flew on 70 miles to the South to deal with the aerodrome at Orleans. Oil centres in Germany, of course, received their nightly attention.

The comparative lull for two days in the raiding came to an end on *Saturday, August* 24, when large formations of German bombers with very strong fighter escorts came over in waves from early morning till late at night. There was a not very destructive raid on Dover, but considerably more damage was done at Ramsgate and at Manston aerodrome just outside it. Various other aerodromes were attacked up to near the outskirts of London, while another

WAR IN THE AIR (CONTINUED)

heavy attack was launched on Portsmouth. None of the raids escaped unscathed. Over Ramsgate one Hurricane pilot shot down three Ju 88s and one Me 109. A Polish sergeant in a Hurricane bagged a bomber and a fighter. A squadron of Defiants was in action three times during the day, and in one battle shot down three Ju 88s and one Heinkel 113 fighter. Later in the day the Defiants increased their bag. The A.A. gunners also had a good day, bringing down a number of enemy aircraft. A trawler joined in the good work by shooting down two bombers. The German losses during the day were 50.

Late at night raiders came over London and incendiary bombs caused fires in parts. These were quickly brought under control by the fire brigades.

While that was going on our bombers were as busy as usual over the Continent, and Italy received another visit. Targets at Milan and Sesto Calende were raided. In Germany the most important raid was directed against the Daimler-Benz works at Stuttgart.

Activities on the German side rather subsided again on *Sunday, August* 25. One rather sensational incident was a 50-mile chase of a Heinkel 111 by a Spitfire, which ended in the bomber bursting into flames and crashing into the sea just after it had reached the coast. There were bombers over London again at night.

Bardia Bombarded

A SPIRITED naval action, with air support, took place on *August* 17 off the coast of Libya, when our Fleet bombarded the port of Bardia and demolished the much-disputed fort of Capuzzo. The machines of the Fleet Air Arm spotted for the guns, and Hurricanes of the R.A.F. acted as air escort for the Fleet. The Italian bombers presently came out to attack the ships, and the Hurricanes engaged them. One of our pilots gave the following description of the air combat:—"I arrived just as five S 79s had dropped their bombs, all well astern of the Fleet, and were making off," he said. "One was immediately shot down in flames, evidently hit by anti-aircraft fire from the battleships. I picked on the leader and gave him about eight short bursts. He fell away and landed in our lines. There were 600 bullet-holes in the 'plane. I had just got a second burst into another machine when it went down in flames. The 'plane was much too close for comfort, so I swerved away just as the crew baled out. The third remaining 'plane was diving like mad for the clouds. I gave him three or four long bursts, whereupon he disappeared with one engine smoking. I think he went into 'the Drink.' These Italian aircraft seem to be built of plywood. At any rate, you have to dodge the pieces that come flying back at you when you fire your guns."

An Italian seaplane was shot down in flames by Gladiator pilots. French pilots attached to an R.A.F. squadron, flying their own aircraft, were on patrol with the British fighters in this engagement.

This action was followed up by a raid by our bombers on the aerodrome at Addis Ababa, which should do something to counteract the loss of prestige which we suffered when we prudently withdrew our troops from Somaliland.

Among the most exciting jobs in this war is that of air gunner in the rear turret of a heavy bomber. One sergeant, who has recently been decorated with the Distinguished Flying Medal, has broadcast an account of the incident which earned him this coveted decoration.

The sergeant said: "It was on the way back from a raid in the Ruhr that these three fighters had a go at us.

"There was no anti-aircraft fire, so I was keeping a particularly sharp look out for fighters. Suddenly, tracer bullets started flying past the turret and I saw three fighters coming in at us from the rear. One was coming in from the starboard quarter and below us. The second was above and practically dead astern, and the third was five or six degrees to port, and he—like the one on the other side—was also attacking from below. To me it seemed that all three were converging on the rear turret. The one on the starboard quarter seemed to be pretty close, so I had first shot at him. The first burst seemed to hit. If you can get your first burst all right, you can usually guarantee to get your following ones in too, unless things are particularly awkward. So I just kept pumping quick bursts into him—six or seven altogether. He was hitting us too. Some of his shots went through the tailplane, the rudder and the wireless mast, and an explosive shell from his cannon hit the armour plating of my turret I didn't realise at the time that the shell had actually hit us. I thought it had exploded just outside. Anyway, I know the bang deafened me for thirty-six hours afterwards. The fighter got to within about one hundred or a hundred and fifty yards of the rear turret; then he pulled up like an aircraft pulling out of a dive. He seemed to hang there for a bit and I got in a few more bursts right into the belly of the machine. I saw him turn over and then I swung the turret on to the second fighter which had been closing in all this time, firing his four guns. I could see four streams of tracer coming at us. Out of the corner of my eye I noticed the first fighter go down in flames. He exploded in the air, or when he hit the deck—I couldn't say which. This second aircraft was the one which was flying slightly to port. I missed him with the first three bursts, because I was misjudging his speed, but the fourth burst hit him all right, and after that I just kept repeating the performance. He was pretty deadly, too, and did further damage to our 'plane. The navigator got hit in the leg—not badly, though—but nobody else was hurt. Then the fighter curled away out of my field of fire and that was the last I saw of him, but the second pilot said he saw him go down out of control. After this the third enemy fighter came down on us. He closed in to about three hundred yards, but wouldn't come any closer. I got a bit fed up with this so I fired a good long burst in his direction and he sheered off. We didn't see him again."

SPEEDY EXACTITUDE. Setting fuses on a four-inch shell for A.A. guns. The naval gunners have been very successful with their high-angle fire.

BOMBER COMMAND

High Spirit of the Air Crews : Desire to "Plaster Jerry"

IF one is feeling a little down in the mouth about the course of the war, the best tonic is a talk with one of our pilots. The other day I heard a Squadron Leader in a heavy bomber squadron, a holder of the Distinguished Flying Cross, discoursing on the delights of his calling. Not for a long time have I come across such an enthusiast, one so full of *joie de vivre*. According to him there is nothing so delightful in the world as a bombing raid by night.

Yet even bomber pilots can sometimes feel depressed, or "browned off," as this officer put it. In the early days of leaflet raids the whole Bomber Command was browned off. This officer admitted that those flights were excellent training, but at the time they were thought tame. Then one day the news came through that the *Deutschland* had been sighted, and they got orders with the magic words "Bombs on." Their excitement was intense and so was their delight. But alas! next day the visibility was too bad, and their raid was cancelled. Disappointment extreme.

"Bombs On"

Then came the Security Patrols over the Frisian islands. Again there came the magic words "Bombs on." But our hero was unlucky; he never saw a flare path and so he never had a chance of dropping his bombs. But one day the Germans bombed the Orkney islands. Again came the order "Bombs on," and again the excitement rose to fever pitch. Off they went to Sylt, and Sylt was a good show.

But all the time the Bomber Command was longing to have a crack at the Ruhr, and at last the invasion of the Low Countries caused the ban on their activities to be lifted. Then they could fly over Holland, instead of the long round to Northern Germany which they had had to follow on the leaflet raids. It was a strange experience flying over Holland, as there was no black-out there as in Britain and Germany. The whole country was lit up. And so they at last reached the Ruhr. There are any number of targets there; Cologne in particular is simply bristling with targets. The marshalling yard at Hamm, of which we have heard so much in the communiqués, our pilot explained, is a vast place which plays a very important part in the railway system of Germany. It is too large to be all put out of action at one time; hence the repeated visits. So was achieved one great ambition of the Bomber Command. They all had had the one desire, "to plaster Jerry," and, said the Squadron Leader, "we really do plaster him." It is a matter of honour for each machine to find its allotted target, and there is no indiscriminate bombing. If a crew cannot find its target, it must bring its bombs home, and when that happens the crew arrive with glum faces. The only other occasion when one sees a glum face at his station is when a keen young pilot is told that he is not wanted for to-night's raid.

Over the Ruhr and Milan

When the Battle of France began, the heavy bombers were turned on to targets in the rear of the German Army, cross-roads and such-like. This officer found that uninteresting, for one thing because they all simply hated having to bomb France, but chiefly because there was no opposition.

Then they returned to the Ruhr. He admitted that the German A.A. fire and searchlights were pretty good, especially in the Ruhr, where they had had lots of practice, and he had a respect for them, but they did not seem to worry him in the least. Our machines were very strong, and would stand a lot of shooting about. The experience they had gained from the leaflet flights now stood them in good stead, and they found their targets. The Germans had had less experience of night flying, and they came high over Britain by night and did not find their targets. He admitted that the Germans had what Mr. Vachell in one of his novels modestly calls *viscera*, but they were not so well trained as we were. The same applied to their fighters at night. He had once only had a German fighter near his own aeroplane at night, and that one did not attack him. Once one of our bombers surprised a German fighter going to land on a flare path on its aerodrome. Our machine had no bombs left, so the pilot went down and machine-gunned the fighter. Strictly speaking, he ought not to have done it; it was not part of his job, but the Squadron Leader very much approved the spirit which prompted it. The black-out in Germany was good. Sometimes they saw a factory brilliantly lit up, but they were not to be deceived that way, and they would let it alone.

When Italy joined in the war our heavies flew over France and the Maritime Alps to bomb Turin and Milan. On the first raid the weather was very bad over the Alps, and all our machines did not get through. One sergeant pilot from the speaker's squadron did get through and did such good work that he got the Distinguished Flying Medal, to the great delight of all the squadron. The Squadron Leader himself went on a later raid to Milan, and he spoke of it with the utmost enthusiasm as a magnificent trip. It was the best thing he had ever done, and there was nothing like it. The view of the Alps in the moonlight was a sight that lots of people would have paid pots of money to see, and he saw it in the course of duty, for nothing. He found his target at Milan without difficulty and bombed it without any doubt. The A.A. fire was "contemptible." When the crews got back to their Operations Room, all their faces were "beaming like full moons" with delight. He read in the papers that the fires they had started were still burning the next day, and that delighted them all hugely.

The Operations Room

Talking of the Operations Room, the Squadron Leader gave some account of how the official reports are compiled. As the machines land on return from a raid, the crews are taken by transport to the crew rooms, where they take off their flying clothes, and then go to the Operations Room to report to the Intelligence Officer. He is a very experienced man, often an Army officer who served in the last war. He questions each man and compares all the reports. It is common for the younger and enthusiastic pilots to be apt to think they had accomplished more than they really had done. The older and more experienced men are much more judicious in their estimates, perhaps erring somewhat on the side of understatement. The Intelligence Officer has plenty of experience in sorting these things out, and in the end the official report never exaggerates the amount of damage done by the raids.

The Squadron Leader ended by saying that there was only one point on which he would like to use superlatives, and that was the work of the maintenance men. It was these aircraftmen who kept the machines, engines, armament, and instruments in good order (incidentally in all his talk the Squadron Leader had never mentioned engine failure) and for them no words of praise could be too high. The air crews got into the news and were given D.F.C.s and D.F.M.s, but the maintenance men were never in the limelight at all, though everything depended on them.

Then the Squadron Leader hurried away. He was in a fidget to catch his train, for fear he should miss that night's raid.

I wonder where he went that night, and what his adventures were. No doubt I have read the official report of the raid. The officer's personality is now buried once more in official phraseology, but I should like to thank him for giving me a glimpse of the human side of the Bomber Command and of the gay, gallant spirit in which its pilots set forth to smite the enemy.

F. A. DE V. R.

SKY—SWEEPING

How oft do they with golden pinions cleave
The flitting skies, like flying pursuivant
Against foul fiends, to aid us militant?
—Spenser

WATCHING and waiting for the enemy are the key words of the Fighter Command Squadrons who have thrilled the whole world—the German *Luftwaffe* included—with their handling of the recent mass air attacks.

Highly skilled and devoted ground crews keep the machines—Hurricanes, Spitfires, Defiants or Fighter Blenheims—in perfect trim and in a state of instant readiness, while the Observer Corps with their plane tables plot the course of the raiders. This and other information is passed via report centres to Operations H.Q. of the Fighter Command. Pilots whose trick of duty it is are already in flying overalls and close to their machines.

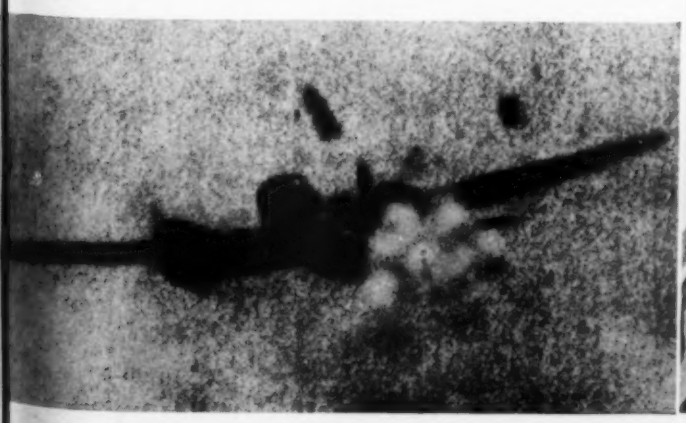
AT the word "go" the ground crews start already warmed engines as if by magic and are ready to help their pilot—in whom they have a distinct proprietary interest—into the cockpit the moment he has donned the remainder of his flying gear and parachute.

A short taxi into wind in formation and thousands of Bristol or Rolls-Royce horse-power are called into play to reach the raiders in the minimum time and enable an attack to be made before the target is reached. Wheels are already up as they cross the aerodrome boundary.

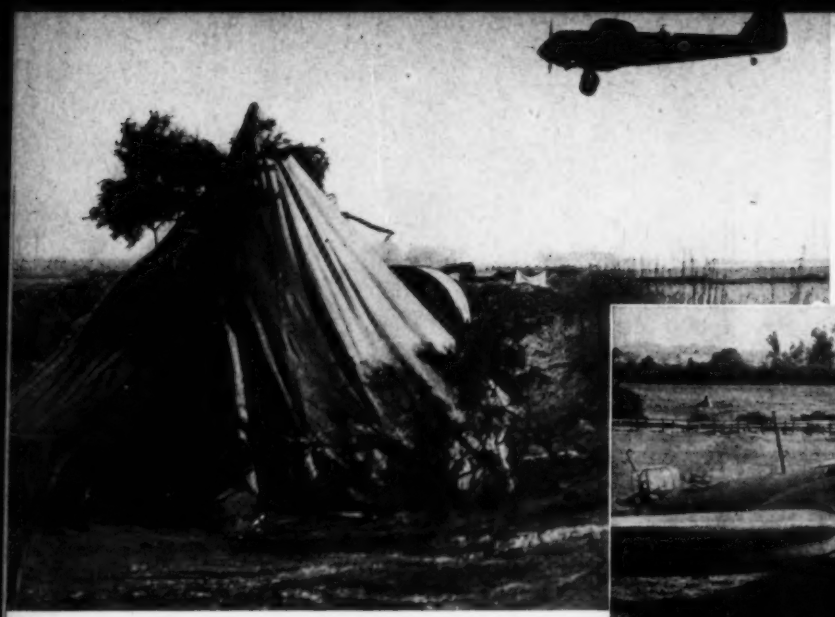
CONTACT with the enemy at any height between zero and 30,000 ft. —Ju.87s or 88s, He.111s, Do.17s or 215s, Me.109s or 110s? How many? Odds are forgotten in the heat of the moment.

Eyes are focussed on reflector sights and thumbs caress the trigger button on the joy-stick spade grip. Four hundred odd miles per hour shows on the "clock" perhaps. A target appears for a fleeting second or two, and the eight Browning guns speak; it really sounds like a terrible laugh, and down goes another German bomber or fighter.

The front view of a Hurricane is the last thing seen by many a German air-gunner, and the Defiant, with its four-gun turret, has a technique entirely of its own.



SKY-SWEEPING (CONTINUED)



BACK to earth again. Almost before the props have stopped ground crews are again hard at work refuelling and rearming to be ready for immediate action again. Zwicky petrol lorries, with multiple deliveries, pump high-octane petrol into the tanks while a party of armourers bring thousands and thousands of rounds of various ammunition to feed the Brownings.

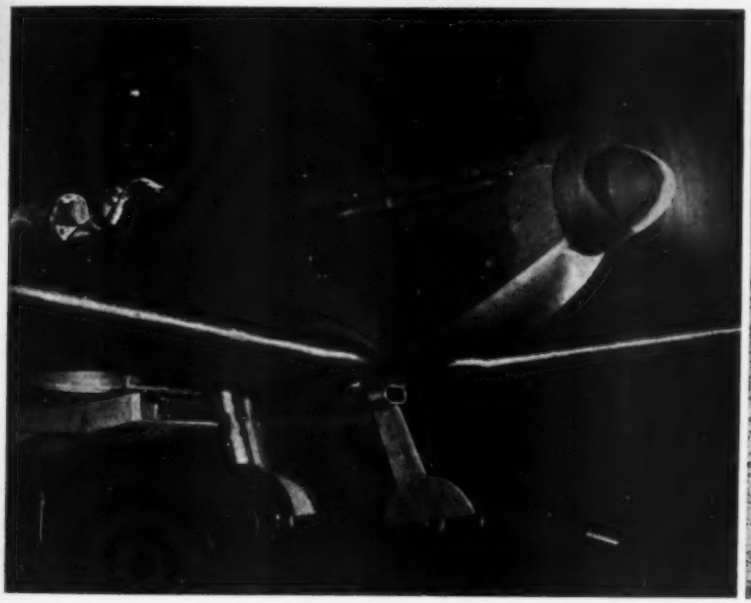
Oxygen bottles must be changed for full ones in case the next scrap is at 20,000 ft. or more. An air fight is a warm business and a cup of tea—hot and sweet—is very acceptable.

SKY-SWEEPING (CONTINUED)

AND so all is set once more for instant action should the need arise. By day and by night, fair weather and foul, the Squadrons of Fighter Command are ready to give of their very best.

Occasionally the fortunes of war go to the enemy—whatever else he may be the German is no mean fighter—and a pilot "takes silk." If he can come home with his brolly under one arm, the ring in his other hand and a smile on his face, the enemy have not done much damage.

Finally, it must give the P.B.I. satisfaction to do sentry go on the fuselage of a vanquished Dornier.



Supplement to FLIGHT

THE AIRCRAFT ENGINEER

No. 175. (Volume XIX No. 8) 15th Year August 29, 1940.

THE SPEED CUBIC

An Alternative Solution

By RICHARD M. CLARKSON

MR. KEITH TURNER'S interesting article on the solution of the Speed Cubic in *Flight* prompts me to submit an alternative method of solution which may possibly interest your readers. It has been in use for over two years and has the advantage of being simple, quick and accurate; it avoids the use of awkward roots, and keeps the physical significance of the quantities in view.

We have $HP_a = HP_p + HP_i$

or $$\frac{HP_p}{HP_a} = 1 - \frac{HP_i}{HP_a} \quad .. \quad .. \quad .. \quad (1)$$

where HP_a = H.P. available (thrust power).
HP_p = Parasite drag H.P.
HP_i = Induced drag H.P.

Expressing the above quantities in terms of speed, drag, weight, atmospheric density, airscrew efficiency, B.H.P., and span loading, we get :—

$$\frac{D \cdot \sigma \cdot V^3}{1{\cdot}77 \times 10^6 \times \eta P} = 1 - r$$

or $$V = 121 \left(\frac{\eta P}{D\sigma}\right)^{\frac{1}{3}} \times (1 - r)^{\frac{1}{3}} \quad .. \quad .. \quad (2)$$

in which V = True airspeed (M.P.H.).
η = Airscrew efficiency.
P = B.H.P.
D = Parasite drag of aircraft in lb. at 100 ft./sec.
σ = Relative atmospheric density.

$$r = \frac{HP_i}{HP_a} = \frac{0{\cdot}33\ K \times W/\eta P \times W/S^2}{V \times \sigma}$$

where K = Factor for non-elliptic load distribution.
W/S^2 = Span loading.
$W/\eta P$ = Thrust power loading.

Equation (2) is solved by means of the two curves on the attached figure, which are self-explanatory. It is necessary to approximate a value for V in estimating r, but since, for conventional aeroplanes, r normally lies between 0.05 and 0.20 and the value of $(1 - r)^{\frac{1}{3}}$ is relatively insensitive to r. One approximation only is generally necessary. Naturally D may be expressed in any other convenient form by suitable adjustment to the constant in equation (2).

It is interesting to note that curve A gives the speed that the aeroplane would do if there were no induced drag, $r = 0$ corresponding to no induced drag, $r = .5$ to flight at max. L/D where the induced drag is half the total drag.

By differentiating Eqn. (2) with respect to each of the four variables in turn we obtain the following relations :

$$\frac{\eta P}{V} \cdot \frac{dV}{d\eta P} = + \frac{1}{3 - 4r} = \epsilon p \text{ (say)}$$

$$\frac{D}{V} \cdot \frac{dV}{dD} = - \frac{1 - r}{3 - 4r} = \epsilon d \quad ,,$$

$$\frac{W}{V} \cdot \frac{dV}{dW} = - \frac{2r}{3 - 4r} = \epsilon w \quad ,,$$

$$\frac{\sigma}{V} \cdot \frac{dV}{d\sigma} = - \frac{1 - 2r}{3 - 4r} = \epsilon \sigma \quad ,,$$

which are plotted on the graph overleaf (Fig. 2). This is a useful companion to the other graph and shows the relative sensitivity of level speed to the several variables which determine it; and demonstrates further the im-

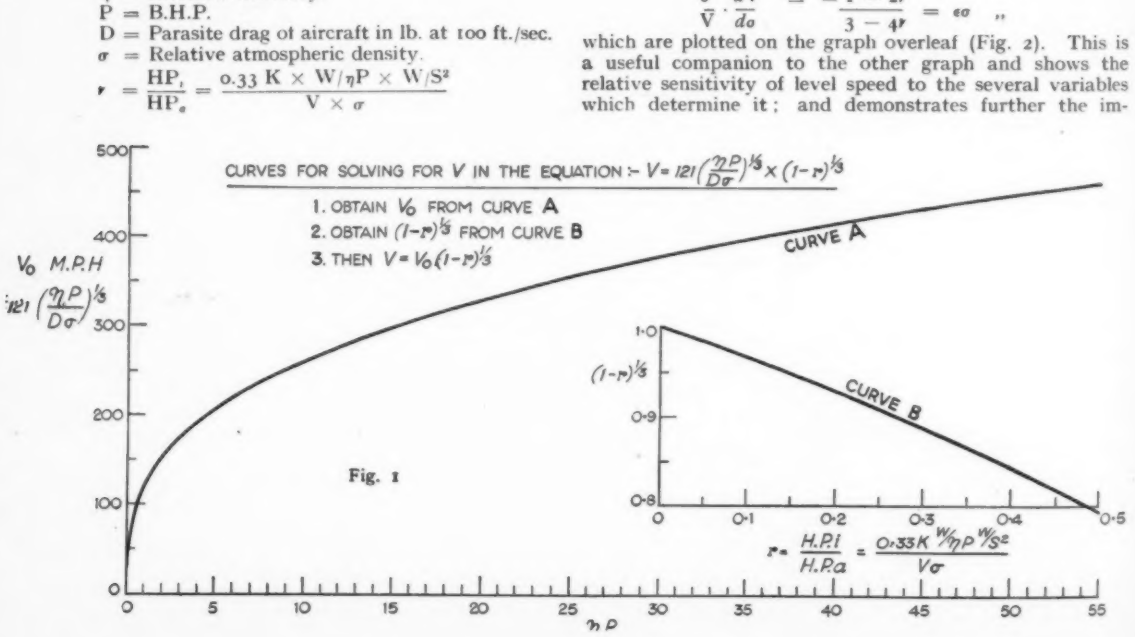

CURVES FOR SOLVING FOR V IN THE EQUATION :- V = 121 (ηP/Dσ)^1/3 × (1-r)^1/3
1. OBTAIN V0 FROM CURVE A
2. OBTAIN (1-r)^1/3 FROM CURVE B
3. THEN V = V0 (1-r)^1/3
V0 M.P.H
121 (ηP/Dσ)^1/3
CURVE A
CURVE B
(1-r)^1/3
r = H.P.i / H.P.a = 0·33K W/ηP W/S² / Vσ
ηP

Fig. 1

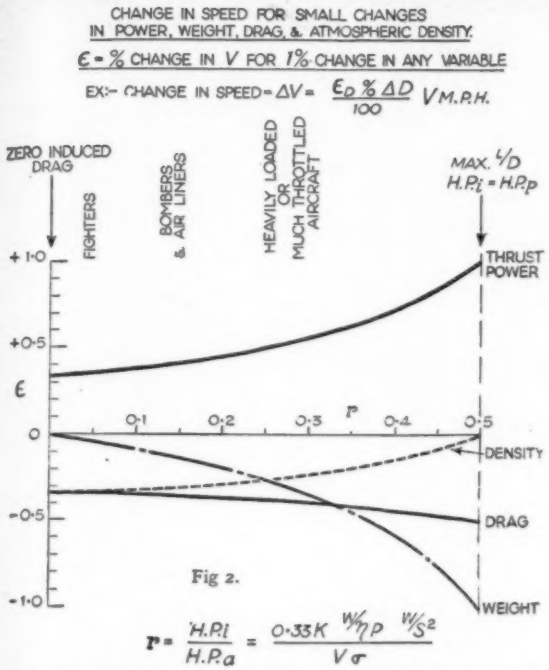


Fig 2.

portance of the parameter r which, as will be seen, controls this sensitivity.

The following examples demonstrate the use of the curves:

1. What is the speed at 18,000ft. ($\sigma = 0.57$) of an aeroplane having the following characteristics?

$D = 150$ lbs. at 100 ft./sec.
$W = 16{,}000$ lbs.
$\eta = 85\%$.
B.H.P. $= 1{,}500$ at 18,000ft.
$S = 55$ft.
$K = 1.10$

$$\frac{\eta P}{D\sigma} = \frac{0.85 \times 1.500}{150 \times 0.57} = 14.9$$

Therefore from curve A (Fig. 1) $V_0 = 298$ m.p.h.

$$r = \frac{0.33 \times 1.1 \times 12.6 \times 5.3}{280 \times 0.57} = 0.152 \quad \text{(assuming V = 280 m.p.h.).}$$

Therefore from curve B (Fig. 1) $V = 298 \times 0.946 = 282$ m.p.h.

Note that the value of V_0 obtained from curve A gives a good indication of the value of V to be assumed in estimating r, thus allowing the one approximation to be sufficient for all practical purposes.

2. What would be the effect of modifying the engines to give 1,650 B.H.P. at 20,000ft. ($\sigma = 0.53$), η assumed constant?

$\%\ \Delta P = +10\%$ and $\%\ \Delta\sigma = -6.5\%$

and from Fig. 2, using the above value of r

$\epsilon p = +0.42$ and $\epsilon\sigma = -0.30$

$$\text{Therefore } \Delta V = 282 \times \frac{10 \times 0.42 + -6.5 \times -0.30}{100}$$

$$= 282 \times .06 = +17 \text{ m.p.h.}$$

An accurate calculation by Fig. 1 would have given +16 m.p.h.

For rough mental working it is convenient to memorise the following average values:

ϵp	+0.40
ϵl	−0.35
ϵw	−0.15
$\epsilon\sigma$	−0.30

THE THEORY of POSITION ERROR

By. J. LOCKWOOD TAYLOR, D.Sc.

IT is well known that, in the usual method of measuring speeds of aircraft by observations of the dynamic head, or air pressure, due to the forward motion, errors arise which are not attributable to any calibration or other defect in the instruments used. Apart from any slight departure from unity of the value of the calibration constant for the total head tube, to which reference will be made later, the air-speed indicator gives correctly the velocity relative to the aircraft of the air at the position selected for the pitot, but this differs from the free air velocity by the amount of the local air velocity set up by the aircraft itself. Hence consideration in general terms of this local velocity and of its variation with speed of aircraft throws light on the so-called position error and facilitates the interpretation and reduction of flight observations.

The dynamic head is the difference between the total and static heads, and the former can be regarded as correct, provided the tubes are clear of the frictional layer, as will normally be the case, the error occurring in the static. The corresponding speed deviation can be split into two parts, one due to the streamline flow, without circulation, and the other to circulation round the wing. The former is proportional to the actual forward speed of the machine, whilst the circulation theory of lift shows that the latter is inversely proportional to the speed. Hence the total P.E. can be written

$$dV = aV + b/V$$

where a, b are constants. This equation applies to the aircraft in a given condition of loading (all-up weight) and at a stated height. More generally, when variations of weight and air density are considered,

$$dV = aV + bW/\sigma V.$$

Re-writing this as $d(V\sqrt{\sigma/W}) = aV\sqrt{\sigma/W} + b \div V\sqrt{\sigma/W}$ gives the original form of equation with $V\sqrt{\sigma/W}$ substituted for V, and suggests a suitable form for plotting, a single curve applying to all weights and heights. σ is, of course, the relative density of the air, and W the weight of the aircraft. In practice it will probably be found convenient to use, instead of W, the actual weight, the ratio W/W_0 of the actual weight to the weight in standard full-load condition, the form of the equations remaining the same. For the standard condition the equation given then reduces to

$$d(V\sqrt{\sigma}) = aV\sqrt{\sigma} + b \div V\sqrt{\sigma},$$

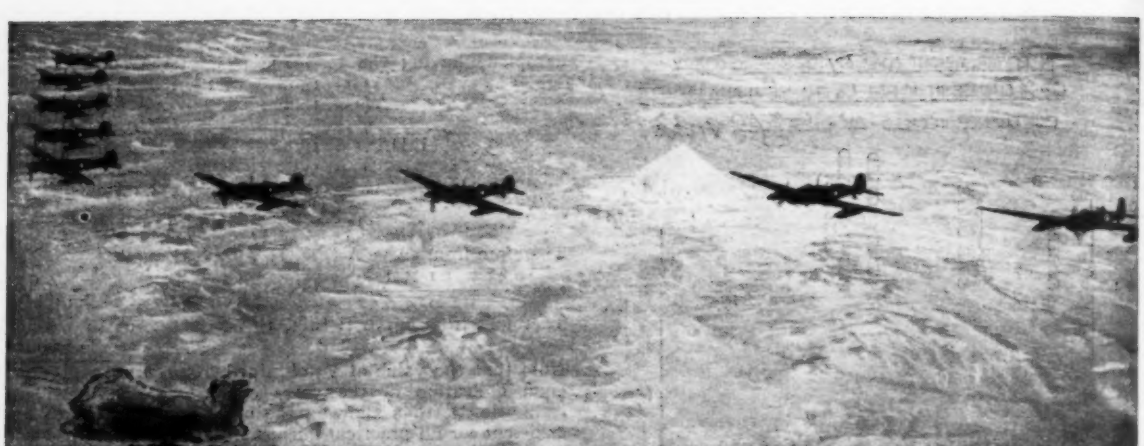
a familiar form, since it involves indicated air speed and indicated position error only.

To evaluate the constants a and b, assuming the results of observations of ground speed, or of flight tests using a suspended static head to give corrected readings, to be available, a linear method of plotting is convenient. To obtain this, a slight rearrangement of the general equation gives

$$V\sqrt{\sigma}.d(V\sqrt{\sigma}) = aV^2\sigma + bW,$$

the R.H.S. being linear in $V^2\sigma$, the square of the I.A.S. Hence the observed P.E.'s multiplied by the I.A.S. should give a straight line when plotted against I.A.S. squared, from which the constants can be deduced.

The L.H.S. of the equation just written is seen to be equal to $d(V^2\sigma/2)$, i.e., the P.E. expressed in terms of dynamic head. Hence, should the calibration constant of the total head tube differ appreciably from unity, involving an error in the observed dynamic pressure which is a constant fraction of the pressure, this, although not strictly a position, effect will be included in the position error, but will not cause any departure from linearity in the plotting as described, nor will it invalidate the equations given, the only effect being to modify the values of the constants, more particularly a. In this case the results of any flight tests using a suspended static head will require separate correction for the calibration constant, the latter being derived from independent wind-tunnel tests.



The A.O.C -in-C. has, in the Vickers Wellesley, a bomber of very long range.

THE MIDDLE EAST COMMAND

Our Offensive Defence : Troubles from Heat and Sand

BEFORE the war the R.A.F. Command of the Middle East comprised Egypt, the Sudan, Kenya, and was responsible for the maintenance of units in Palestine and Transjordan, though the last-named were under the operational control of the Army. Since the outbreak of war the Command has been expanded by adding to it three previously independent Commands, those of the Mediterranean (with headquarters at Malta and a branch at Gibraltar), Aden and Iraq. The headquarters of the Middle East are at Cairo, and the Air Officer Commanding-in-Chief has wide powers; he can reinforce one part from another of his Command without referring to the Air Ministry. The inclusion of the Mediterranean Command with its G.R. squadrons gives the A.O.C.-in-C. responsibility for the patrol of the Eastern Mediterranean from Malta to Egypt. The air contingents from the South African Air Force and from Rhodesia also come under his orders, and they are now being re-equipped, while the Egyptian Air Force can be looked on as a reserve, though Egypt is not yet a belligerent.

At the outbreak of war we considered that we had a sufficient air force in the Command, but the collapse of France set free certain Italian forces for use against us. The Italians have some 500-odd aircraft in Libya, some of them of modern types. Incidentally, we reckon that the *Regia Aeronautica* in Italy has a strength of about 1,500 aircraft. In the Dodecanese islands (Rhodes and others) the Italians have in round numbers 30 bombers and 20 fighters, seaplanes, etc. In Italian East Africa the Italian strength is put down as 170 machines, about 25 per cent. of which are fighters. Ethiopia is 1,700 miles away from Libya, so although Italian bombers might make the flight from the latter to the former by night, and may have done so, reinforcement on a large scale is not a practical proposition.

Reinforcements Arrive

Our policy may be described as an offensive defence. We keep it in mind that it is the final victory which matters, and the A.O.C.-in-C. has to resist requests to disperse his force. As has happened in this country, there are requests at times for fighters to protect each post which has been raided by the enemy, but they cannot be granted. Our advanced fighter squadrons on the frontiers are relieved at intervals, so as to rest the men and also to give all units experience in tackling the enemy. The Gladiators have proved quite able to overcome Italian resistance, but there are now Hurricanes in the Middle East, and when it comes to a pursuit of a speedy Savoia S79 these will have an advantage over the slower Gladiators. Incidentally, the Italian authorities, to excuse the poor results of their air raids on Malta, put it about that Spitfires had been seen over the island. Since then it has been noticed that the Italian pilots show even less enthusiasm for pressing their attacks against the island, and the other day one of their formations turned back as soon as our fighters were seen in the air, although they were many miles distant from Malta.

Desert Warfare

The need for resting squadrons applies to the maintenance aircraftmen even more than to the pilots, though all have a trying time when camped in the western desert near the border of Libya. A gentle breeze of ten m.p.h. will lift the sand, and it gets into everything. Men find that they can actually breathe better in their gas masks—until the latter get choked up with sand. So life under canvas is not pure delight. Inside an engine the sand mixes with the oil to form an excellent grinding mixture, which means heavier work for the fitters. The machines have to stand out in the open, and the metal parts get far too hot to touch. More trouble for the fitters and riggers and armourers. Those troubles, of course, affect both sides, but the R.A.F. have taken more trouble in finding out how to overcome them. The Italians have been improvident in their maintenance system. The dust storms often make a haze up to 10,000 feet with nil visibility. It was one of these which recently cost the life of a very gallant Flight Lieutenant of a Gladiator squadron.

In a country where roads are few and all movements are governed by the question of water, aircraft naturally play a great part. It is not possible to hide large concentrations of troops from air reconnaissance, and on the Libyan frontier our medium bombers, largely Blenheims, have been doing excellent work in bombing Italian troops. They also work with our own desert troops, which have been using small compact forces, and there, too, we have a great advantage through having studied the best forms of vehicle for use on the sandy desert.

Owing to the paucity of roads in Northern Africa, most of the communications are by sea, and the Royal Navy controls the sea. Italian ships do try to run the gauntlet, but our G.R. squadrons have been doing excellent work in patrolling the Eastern Mediterranean.

THE MIDDLE EAST COMMAND (CONTINUED)

While it must be freely admitted that the best Italian pilots are very good—we respect the names and memories of Bernardi, Ferrarin, Balbo, Monte, Dal Molin, Agello, and others—our pilots in the Middle East have no exaggerated respect for the average Italians. The percentage of Italian losses has been higher than that of the Germans, and in the Middle East we have made 50 per cent. more bombing attacks on the Italians than they have made on us. We have destroyed nearly 200 Italian machines in air combat with small loss to ourselves. We can reinforce, and lately the fighter strength at Malta has been reinforced, and the arrival of Hurricanes in the Command is another instance of reinforcement, while it is not an easy matter for the Italians to reinforce Libya and it is practically impossible for them to reinforce their men and supplies in East Africa. Their advance into Somaliland must have been for the purpose of impressing the Abyssinians. In Ethiopia the Italians are constantly faced with the fear of rebellion, which will have been increased since the Negus, Haile Selassie, arrived in the Middle East. Constantly they have to use up precious petrol, and also shorten the lives of equally precious aircraft, by flying over disturbed areas and bombing gatherings of Abyssinian patriots who long for the time when British arms will free their country from Italian rule. We can imagine the stimulus given to the patriotic movement when quite lately our bombers appeared over Addis Ababa and bombed the aerodrome there. Of course, our evacuation of Somaliland must be a blow to our prestige for the time being, but, after all, it is the final victory which counts, and in the Middle East, as elsewhere, we have no doubt as to what the final result will be.

BOOK REVIEWS

American Aviation Directory, published by American Aviation Associates, Inc., Earle Bldg., Washington, D.C.

THIS useful book gives a great deal of authoritative information about air transport and aircraft manufacture in America. It is considerably more than a personnel directory, although a very great proportion of the 234 pages are taken up with listing the names of all executives employed by the airlines, factories, financial companies, schools, governmental and other aviation organisations. It also gives factory areas, number of employees, monthly payroll, allocation of personnel to various departments, and value of the "backlog." For the airlines, their routes, route-miles and equipment, as well as number of pilots and other employees, are given.

With each division printed in easily readable type on different colour paper, reference is very easy. Not the least of the book's virtues is its circular wire binding which allows it to open flat and stay open.

Number 1 has just appeared and a second edition will come out later in 1940. Price is $3 per single copy, $5 the two.

Flight Without Formulæ, by A. C. Kermode, B.A., F.R.Ae.S., M.I.Ae.E. 6s. Pitman.

THIS book is thoroughly good. It fulfils its subtitle very adequately, "How and why an aeroplane flies explained in simple language," and, let it be said, without errors, although there is not an algebraical symbol or formula in the book. Mr. Kermode has dropped the traditional chapter form and subdivides his subject into 100 paragraphs, a very suitable method. His explanations of such things as induced drag, circulation, stability, control, and the necessity for controllable pitch airscrews are entirely satisfying for readers who require qualitative and not quantitative answers.

The book appeared to be so correct that I deliberately sought errors, but was only able to find that "Three-bladed airscrews cannot conveniently be made of wood" (they can now) and the omission of magnesium alloy as a blade material now in use. The explanation of wing-flutter was the only one which appeared to be skated over at all, and one cannot really blame the author for this. But for his explanations of stalling and the mysterious, blackout-causing "g," he must be awarded full marks, and the book can be recommended to the air correspondents of our dailies, who have sometimes been known to stumble and falter slightly at these two hurdles.

B. McA. F.

"Carburettors," Part 1. "Instruments," Part 1. "Landing Legs, Wheels and Brakes." "Airscrews." Volumes 1 to 4 in the Aeroplane Maintenance and Operation Series, edited by E. Molloy and E. W. Knott, M.I.A.E., M.S.A.E. 5s. each. George Newnes, Ltd.

THESE books are mainly of use to personnel who are engaged on maintenance work on aircraft as they deal almost entirely with the routine methods laid down for the overhaul and repair of the various components mentioned in their titles. Overhaul instructions are to-day deserving of more and more study owing to the ever-increasing complexity of modern airframes and engines.

The volume on carburettors starts with a sketchy five pages on the principles of carburation and then goes on to describe the maintenance of ten different types of Hobson carburettors. The last chapter is on the Hobson boost control, including the variable-datum boost control, and the working of this mechanism is explained.

The instruments book, volume 2 of the series, is taken up largely with a description of the Sperry artificial horizon, directional gyro and automatic pilot. The working of these instruments, as well as their maintenance and testing, are covered, but one could wish for a little more complete treatment of the theory. The precise nature of the phenomenon of precession, for example, must mystify many a mechanic. Of course, as the jacket says, the book is concerned with the "severely practical aspects of installation, operation and maintenance." Valuable sections on fault-finding and questions and answers are included. The remainder of the book is devoted to Smith's aircraft instruments.

In the landing legs, wheels and brakes volume the maintenance and repair of Lockheed, Vickers, Turner and Dowty shock-absorber units are described. The fitting and removal of Dunlop tyres and the maintenance of the Dunlop, Bendix and Palmer braking systems are covered.

The volume on airscrews deals with the two types manufactured by De Havillands to the Hamilton patents, the counter-weight controllable-pitch and the Hydromatic feathering airscrews. There are, of course, several others and it is presumed that later volumes will deal with these. Drawings are given showing the working of both designs, and all maintenance procedure is laid down, including wear tolerances. There seems to be some confusion in chapter headings as in the one called "Hydromatic Airscrew" there are many counter-weight type illustrations, while where the page heading is "Controllable-Pitch Airscrew" the illustrations are of the Hydromatic. The controllable-pitch airscrews is so recent that very little literature exists on this subject.

The Aeroplane Structure, by A. C. Kermode, B.A., F.R.Ae.S., M.I.Ae.E. 6s. Pitman.

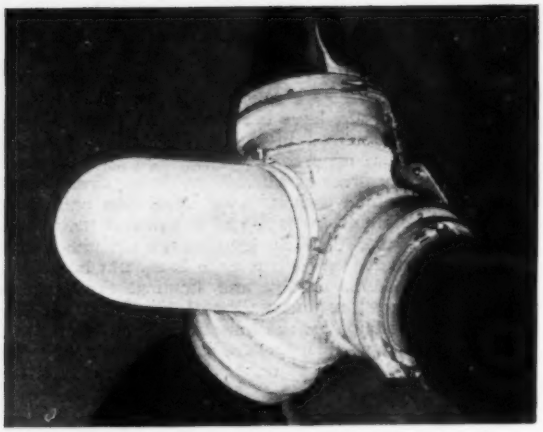
"FOR those who have a good knowledge of mathematics and mechanics . . . many good books are available. . . . But many others have not reached that standard . . . and it is for them that this book has been written." So says Mr. Kermode in his preface, and, as in "Flight Without Formulæ," the job has been well done. The book gives any reader who will take the trouble to read carefully a good knowledge of the structure of an aeroplane. The differences between beams, ties and struts are explained, as are yield point, load factor and factor of safety. These last are particularly clearly explained and the sketches illustrating the book are very good.

One might perhaps join issue with the author on just how much of an aeroplane is designed by "eye" and whether the general layout is "the creation of an artist." The rather widely-held idea that when "a thing looks right to a good engineer it usually is right," is not nearly so true as it perhaps once was. Rather is it a designer's genius for successful compromise which will put him ahead of other designers possessing the same technical information. And might I be allowed to plead with the author to use the term "nosewheel undercarriage" instead of "tricycle"? After all, the undercarriage to which we have been used for so long, and which I prefer to call a tailwheel undercarriage, is also a tricycle. But these are minor points and are not even criticisms of what is undoubtedly a good book.

B. McA. F.

ROTOL ELECTRIC AIRSCREW

Details of Mechanism and Technique of Operation



The ingenious mechanism of the Rotol electric is hidden in this simple boss.

IN our issue of August 15 we published an article, "Variable Pitch Airscrews," dealing in general terms with the advantages of this type of airscrew, and particularly of those which can be reversed in pitch and have a mechanism for locking the blades at any desired angle. To-day this description of the Rotol electric airscrew is given and the details of its mechanism. To follow this out, reference should be made to the illustration on page 124f of the August 15th issue. In addition, our article gives the technique of operation to be used by the pilot in manipulating the controls on the instrument board.—ED.

Electric operation of variable-pitch airscrews has been successfully employed in other countries for several years, but now a British-made electric airscrew is available. Rotol Airscrews, Ltd., of Gloucester, have come forward to supply the need and so provide another very useful feather for the "lion's wings."

The electric airscrew is of very advanced design, and its versatility of operation covers all the requirements and emergencies of flight. It may be said to be a three-in-one airscrew in that it can be flown as a constant-speed, manually controlled, or fixed-pitch unit. In addition, it can be feathered quickly and easily in an emergency, and for the manœuvring of flying boats upon the water its blades can be reversed to turn the craft within a circle of radius equal to the wing span. In sum, the electric airscrew, from an operational viewpoint, incorporates the advantages of all other airscrews.

The Rotol airscrew is designed for use on multi-engined aircraft, for which feathering is these days regarded as an essential characteristic, while locking the pitch is highly desirable. Despite its apparent complexity, installation and maintenance have been simplified greatly, and the weight of the airscrew is very satisfactory, the types fitted with wooden blades being really remarkably light for the power transmitted.

Mechanical Details

To understand the uses of an electric airscrew it is necessary to know something of its mechanism. The changing of blade angle is done by an electric motor driven by the aircraft batteries. This is an advantage over hydraulic operation, since it relieves the airscrew of dependence upon the engine. The drive of the electric motor is conveyed through a double epicyclic reduction gear to a master bevel gear which meshes with bevel gears on the base of each of the blades. The blades are retained in the hub in stacks of thrust-bearing races, and their pitch changes as the master bevel gear is turned by the motor. The current to the motor passes from the aircraft to the airscrew by a brush and slip ring assembly, and thence through connector leads in the hub and reduction gear. Three slip rings are for the fine, coarse and feathering circuits, and the fourth is the common negative. Current comes either directly, as with the manual control, or from the constant-speed unit. At the end of the motor armature-shaft is a Ferodo-lined brake, operated by a solenoid, which comes into action as soon as the current flow ceases, and so locks the blades in whatever pitch they happen to be.

The constant-speed operation of the airscrew is exactly similar to that of a Rotol hydraulic airscrew (see *Flight*, March 23, 1939, page 296), and its control is thus effected in the same way. That is to say, the pilot can adjust the lever to produce any required r.p.m., and the engine will be held to it, by changes in the pitch of the blades, irrespective of the altitude or attitude of the aircraft. The function is purely automatic.

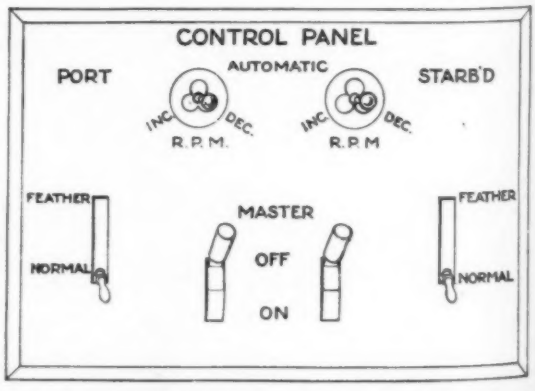
The difference in principle between the hydraulic and electric constant-speed units is that in the former case directional changes in the flow of pressure oil are used to change the pitch of the blades, while in the latter, oil pressure controls electric contacts, and the electric motor changes the pitch. The electric governor unit is interesting in design, consisting basically of a pair of bell crank weights on a driving plate, attached through a splined shaft to the auxiliary drive of the engine. These weights are sensitive to variation in engine r.p.m., and control the pressure of oil brought to bear upon a spring-loaded piston which, in turn, controls the electric contacts.

De-Icing and Maintenance

Rotol's electric as well as their hydraulic airscrews are fitted with slinger-ring type de-icing equipment. Hub-mounted pipes carry the de-icing fluid to a trough with a nozzle which discharges the fluid to the leading edge of each blade. The trough is attached to the blade and to it the fluid is forced from the slinger ring. In icing conditions the pilot has only to turn on his de-icing pump and the fluid flows on to the blades. Should ice have begun to form on the blade a drop in r.p.m. will be noted if the pitch has been locked.

Maintenance considerations have been made easy by design. The motor and reduction gear are interchangeable and a new unit can be fitted at any time without the necessity of removing the airscrew from the shaft. The airscrew need seldom be out of service for maintenance.

Stripped of the motor and reduction gear it consists in



The simple control panel for a twin-engined installation. The use of the three-way switch is explained in the text. Practically all control is effected by this one switch.

ROTOL ELECTRIC AIRSCREW (CONTINUED)

the main of hub and blade assemblies only, and few special tools are needed for maintenance work.

Operating Technique

For operating purposes, the controls in the cockpit consist of three switches for each airscrew. The first is a master switch which serves also as a thermal throw-out switch to protect the circuit from possible overloading. The second is for quick feathering, controlling the auxiliary feathering booster which is used only in emergency. But the most used switch is the third one, which is of the "three-way" toggle" variety and determines whether the airscrew is flown on the constant-speed unit or in fixed pitch, and also provides the manual control. In the central position of the switch, the circuits are open and the blades are locked in fixed pitch. Pressed upwards the switch is put into the "automatic" position, the airscrew is constant speeding and the engine r.p.m. can be controlled by the constant-speed control lever in the normal way.

For manual control the switch is held downwards to right or left of the central position, to which it springs back if pressure is released. Thus, when flying in the fixed pitch position, the pilot may reduce his engine r.p.m. by a brief touch of the switch to the left. This will increase blade angle until the switch is allowed to spring back to the central "locked pitch" position. Similarly, r.p.m. can be increased by a slight movement of the switch to the right.

This method of control is recommended for small adjustments in flight but for drastic changes of conditions the procedure is to put the airscrew on to the constant speed unit. Automatically, the pitch corresponding to that engine speed will then be selected, and when the aircraft has levelled out, the blades can be locked once more. Thus "take-off" should be effected by constant speeding. For landing, the airscrew is best locked in the cruising pitch which, while not imposing undue drag on the aircraft, will permit thrust to be obtained immediately, should an emergency climb be necessary.

Since on long flights the airscrew is normally flown in fixed pitch, the current consumption, which is low in any circumstances, is practically negligible. Economy in petrol is also caused by the fact that in fixed pitch, fuel consumption can be checked on the panel instruments and adjusted as required. Ignition drop and falling off in engine power can also be noted from the reduced r.p.m., and in the event of partial or complete engine failure, damage or other emergency, the airscrew can be feathered. This is accomplished in a few seconds on the feathering booster, or more slowly but with less strain on the aircraft batteries, by simply holding the toggle switch in the "reduce r.p.m." position until the blades reach the coarse pitch stop. Naturally this is only done when the engine is "dead." For unfeathering, the procedure is to move the blades towards fine pitch until the airscrew begins to windmill, and then gradually to bring the engine back to normal r.p.m. and power. Unfeathering, with a cold engine, should always be effected slowly, the sensitivity of the manual control making this a simple matter.

Though undoubtedly the airscrew has become more complicated with every year that has passed, it has also become more efficient and considerably safer. Feathering is a characteristic which, by reduction of drag, adds safety since it increases the range of a damaged aeroplane and its chances of reaching a safe landing ground. And efficiency comes from locking the pitch and so immediately showing up any engine fault which is causing a drop in power. It seems that this airscrew gives the pilot everything which he desires, including as much simplicity of control as possible.

Gifts for Aircraft Fund

THE fund to which the public are subscribing to buy aircraft grows apace, and each day brings forth a long list of new names. Everybody wants to buy a Spitfire, or a part of one, at any rate, although there have, of course, been cases of one person buying not only one, but several Spitfires. It is the Spitfire which has caught the public imagination, and to be able to regard oneself as the owner or part owner of one of these fighting craft engaged in the defence of England is a very powerful means of causing the private person to give, and give liberally.

The Hurricane, unfortunately, seems to be left out in the cold, though it has done nothing to deserve this fate. Its record is every bit as proud as that of the Spitfire. No doubt many of the people who look up into the sky at fighters think only of Spitfires when what they actually see is a squadron of Hurricanes. But it matters little. What does matter is that the list of subscribers is too long to publish and the total subscribed very great.

But some of the gifts catch the eye, and one notices £5 from Aylesbury Gaol, coming in part from the earnings of women prisoners. Then the British in China have sent £52,000, and the Hosiery Manufacturers are busy at work collecting thousands. Things as widely divergent as an impromptu moonlight dance yields £5, while the Fashion Trades Association produces £5,000 in 36 hours. But in Northern Ireland a fund which has reached £30,000 owes some of its success to the live stock contributed—two goats, a gander, a cow, a greyhound, and a donkey.

Mr. J. W. McConnell, proprietor of the *Montreal Daily Star*, has given a million dollars. That should pay for a lot of aeroplanes, be they Spitfires, Hurricanes or any of the numerous other types that are being used. The Unilever staff is giving £20,000 in weekly instalments, and the people of Guildford have got enough to buy their first fighter in 12 days. Nor can the old-age pensioner widow of Barnstaple be forgotten; she sent ten shillings. And two interned aliens sent £5 each—coals of fire. The Dominions, too, are collecting, and New Zealand has set out to raise £100,000, a goodly contribution for a small population.

Comforts for the R.A.F.

THE Royal Air Force Comforts Committee are making an urgent appeal for gifts to meet the needs of the rapidly increasing number of men in the service. Gifts, including all woollen comforts, should be sent to the Officer-in-Charge, Royal Air Force Comforts, 20, Berkeley Square, London, W.1.

It is hoped that knitting parties who have discontinued work during the summer will reassemble now, so that if winter should be early a good stock of woollen comforts will be ready.

Some parties in the poorer localities may find difficulty in purchasing more wool this season. To encourage them to continue their work the Committee will arrange, where necessary, for a free issue of wool.

Knitting parties have been formed all over the world. They vary in numbers from ten, in villages, to groups of over a thousand strong. The badges awarded by the Committee for good work are much sought after, and among those who have qualified to receive them are one old lady of ninety-three and a child of nine. Hence the slogan of the knitters: "From nine to ninety." Patterns of the comforts required can be obtained from the Committee.

A large variety of articles are needed for comforts apart from woollen goods. People who have nothing which they desire to give, and who do not knit, are reminded that donations are welcome. All such donations are acknowledged, whether large or small, and the entire sum is spent on the purchase of the desired goods. Nothing is retained for administrative expenses. Donations have, in fact, been sent from all parts of the world, but more money is needed.

Wireless sets and games suitable for use by small isolated units are in particular request, and donations for the purchase of these are especially desired. Pianos and billiard tables have been offered by some supporters, and when they have been found to be in serviceable condition such gifts have been gratefully accepted.

It should be recalled that in addition to R.A.F. personnel there are now in this country numbers of Allied airmen—Czechs, Poles and French—who also require comforts. Responsibility for the supply of their needs has been undertaken by the Committee.

Air Strategy—XVII

APPLICATION of AIR BLOCKADE

The German and the British Objects : Importance of Intelligence Reports

By CAPTAIN NORMAN MACMILLAN, M.C., A.F.C.

AIR blockade may be applied in accordance with two theories : Either it may be intended to deprive the enemy of the greatest number of commodities, or it may be designed to eliminate a selected number of commodities. In both cases its success must be gauged by the results obtained. Up to the moment of writing, it would appear that the German method of applying air blockade follows the first theory, while the British method follows the second.

The first method demands a numerically superior air force, which Germany (at the moment) possesses. But its effectiveness is dissipated by the inevitably widespread nature of the attacks which must be launched to give it effect. It is, basically, an unscientific employment of brute force ; or if one cares to be polite to the German High Command, a scientific employment of brute force. I leave the reader to decide for himself in which category he would place the aeronautical ebullition of the German High Command. (I have my own opinion. The German never did know the meaning of the word *finesse*).

The second method strikes with art at the planned war economy of the enemy. In its results (assuming that the attacks launched are effective) it is far more deadly, for it affects the military capacity of the enemy and weakens it at source.

In the use of the word blockade in what I have just written the reader must appreciate that I do not refer to the bombing of aerodromes or any other objective of a purely military character. I refer to the bombing of industrial plants, industrial stores, food factories and storehouses, communications, and centres of the production of basic raw materials. I do not refer to the bombing of civilian housing areas, for that is not blockade but open warfare in its worst form, for which the German is world renowned not alone in this war but in former wars in which the Teuton has engaged.

Studying the Targets

The art of employing air blockade requires the advance study of specific targets. To those entrusted with the duty of giving effect to a Cabinet requirement for the application of air blockade against a specific product, the strategical study of the terrain of the enemy may disclose a widely scattered array of targets. They may be sited at intervals throughout a series of zones, each becoming more distant from the operating base ; yet each one of those targets will have to be attacked if the product in question is to be effectively eliminated.

So it may prove that those entrusted with the duty of drawing up the plans for air blockade of that particular product may have to report back to the Cabinet that a complete blockade is impossible because it is tactically impossible to reach certain targets which lie in the more distant zones. In this case it is clear that it will be possible to apply partial blockade only. And the report will estimate the percentage of effectiveness which air blockade, under the circumstances, can operate.

Pending the production of aircraft with a greater operational range of action, it will be necessary to attack the targets which apply to that particular product in the zones which can be reached ; and simultaneously to attack the lines of communication between these zones and those which lie beyond operational range, to prevent the free circulation of the product from the unmolested centres of production.

It is evident that intelligence reports are of the utmost importance, for it is vital to know all the targets concerned in the elimination of a given product ; otherwise the blockade will be reduced in its effectiveness. Thus the kind of intelligence which an air commander requires is different from that needed by a naval or a military commander. And it is for this reason that even the humblest employee of almost every firm in the country must guard his words, for in these days of air war it is not the "man in the street" that counts, but the man in the works.

The application of air blockade is certain to send the enemy in search of alternative sources of supply and production. It is highly important that the earliest possible information be obtained about such moves so that they can be frustrated either by advance or by higher-price buying, or other means of peaceful deprivation ; or by suitable naval, air or military action, or combined action.

Difficult Tasks

With Germany in possession of vast tracts of Europe, and with all France under her domination, it is obvious that there must be great difficulty in applying a complete blockade, even by the combined efforts of Britain's sea and air forces. On the other hand, as Germany is now responsible for the control of the lands she has overrun, it is absolutely imperative for her to maintain her huge armed forces at their maximum strength until she has succeeded in all the plans which have been laid for her by Hitler, or until the attempted execution of those plans breaks down, as those of Hitler's forerunners broke down in 1918.

For that armed force, Germany needs an entirely different kind of planned economy for nearly the whole of Europe. Almost the whole of that unhappy Continent must be placed under the same yoke as that which Germany has borne for seven years ; but, whereas Germany bore it without the stress of war, the Europe which is in bondage to-day has not that advantage ; nor has Germany now. And as Britain's air force continually grows in strength and its power to reach out over Europe extends ever farther afield, from the United Kingdom and from the Middle East, Germany will find it increasingly difficult to maintain the delicate equipoise of supply and demand under the strain of partial sea and air blockade. Then Italy will begin to drain her partner of steel and coal, oil and manufactured weapons, for Italy will feel the draught first.

So it is that Hitler has thrown the *Luftwaffe* at England as he has. By day its strength has been concentrated against the south-eastern portion of England. Why? Not alone to threaten that part of England, in which the heart of the Empire lies, but partly because that part of England is the very pivot of the striking strength of the Royal Air Force. Take a map of Europe. Place one point of a pair of compasses upon most parts of Germany, and upon Northern Italy on those very towns and cities which have been visited by the R.A.F. in their partial blockade of Germany and

APPLICATION OF AIR BLOCKADE (CONTINUED)

Italy. Then let the other point of the compasses swing towards England. It will be obvious that this corner of England is the territorial hub from which the R.A.F. must strike out to reach the greatest distance in its raids over enemy territory. What better reason could Hitler have to concentrate his air strength against it, or to launch any attack he may contemplate objectively to drive back the R.A.F. to aerodromes further inland?

Even fifty miles means a wide belt of fifty miles of freedom from attack for the time being. But only for the time, Herr Hitler. Soon the R.A.F. will strike out farther than at present. Soon there will be no part of Germany that cannot be reached. Soon it will be possible to turn the partial air blockade into a scientific and complete blockade, which no power in Germany will be able to prevent from wreaking the havoc to the planned economy of a nation of which complete air blockade is capable.

The four zones into which I have divided Germany for tactical purposes need here some clearer definition. (See map in last week's issue.) They were not chosen arbitrarily upon a simple mileage basis. They are not defined simply by the mere process of drawing an arc of a circle outwards from a central point somewhere in the United Kingdom. I chose them rather because they represent target areas, each of which contains readily definable targets, and each of which is, geographically, a tactical zone.

Target Distances

The first and second zones (which I defined as the area between the German seaboard—Holland-Belgium in the west and a line running through Hamburg, Hanover, Cassel, Frankfort and Karlsruhe in the east) are the zones within which the heaviest British air attacks have consistently fallen. The distances to its eastern boundary measured radially outwards from the nearest British aerodromes are: to Hamburg 354 miles, Hanover 345 miles, Cassel 340 miles, Frankfort 330 miles and Karlsruhe 345 miles. If one wishes, Kiel can be conveniently taken within this zone; distance 375 miles.

In these first zones our shorter-range bombers can be employed upon the nearer targets. Our longer-range bombers can be loaded up to their maximum capacity with bombs and still not require their full load of fuel. The prior charting of weather by reconnaissance aircraft is easier to accomplish, for that frequently dangerous job must be carried out by day to enable the weather to be forecast for the raiders which have to leave at or just before dusk. The importance of this aerial weather charting has received scant notice so far, for it is not a job where glory shines. The job is one of the silent jobs, in which the aircraft has to go out, get its information, and get back with the minimum of fuss.

Within the second zone are a host of names that must have become familiar to the listeners at the loud speakers throughout the world who "harken in" to the B.B.C. Air Ministry and Ministry of Home Security bulletins: the Focke-Wulf aeroplane works at Bremen (what wouldn't the Focke-Wulf company have given for such advertisement before the war? What would they now give to be without it?); railway marshalling yards at Osnabrück and Hamm (a glance at the map shows their significance); and all the great industrial plants of the Rhineland and the Ruhr; truly, the most western zone of Germany would have been more happy with a neutral Holland and Belgium to serve as a buffer to the shocks which the R.A.F. have inflicted upon it. But Hitler in his anxiety to get at France forgot that it is a good thing to have a breastwork to ward off the blows of modern warfare, and by overrunning Holland and Belgium to bring about the collapse of France he laid open his flank (and a most important industrial flank it is) to the direct attack of the R.A.F. from England. From the point of view of industrial Germany it was a bad move.

The third zone runs eastward from the boundary of the second zone to a line connecting Stettin-Berlin-Leipzig-Nuremberg-Ulm-Friedrichshafen. Here the boundary mileages are 545, 495, 470, 460, 440 and 445 respectively, from the nearest operational aerodromes in England. Within this zone there are numerous targets which are now becoming better known to British listeners —Wismar (one of the Dornier factories), Gotha (of familiar sound), Stuttgart (Bosch and Daimler-Benz), Jena (for Zeiss field glasses, aero cameras and many other optical war instruments), to name but a few.

East of that line lies the zone I have called four. Within Zone 4 the targets lie far to the east until they touch the frontiers of the U.S.S.R. as they are to-day in Poland and Lithuania; the frontiers of Hungary, Roumania and Yugoslavia until, passing through Italy, they join up with the western zone of action of the Middle East Command.

Within Zone 4 there are many targets which we have not yet attempted to attack. Their turn will come. Up to the moment of writing, however, the R.A.F. have struck at *some* targets which lie just inside the zone: at the Messerschmitt plant in Augsburg (480 miles), and at the Leuna oil plant north-east of Leipzig. But this is just touching the fringe of the zone. Saxony, Silesia, Bavaria, Pomerania, East Prussia; aye and Austria, Bohemia and Moravia all contain targets which will have to take their turn if the R.A.F. blockade of Germany is to be driven home.

Need for Long Range

Until we possess aircraft which can reach the furthermost corner of the lands held by Germany we cannot complete that blockade which is so vital to shortening the war. But when that time comes, and with it will come also a vast increase in the air strength of the R.A.F., the sea and land blockade will become complete in spite of the contiguous frontiers which are now open in the eastern part of Europe to trade with Germany. For when the complete blockade is applied, the value of these open frontiers will be cut just as the value of the German North Sea seaboard has been cut by the British Navy.

In the next article I shall enlarge upon the consideration of targets upon which I have touched briefly. But before then it is perhaps well to say (now that London has been bombed in places, and now that the British Government has denounced the air bombardment of an open town, Eastbourne) that Berlin can as a city claim no exemption from attack. There are numerous essential war industries carried on in Berlin, not only on the periphery of the city around about its ring of aerodromes, at Spandau, and at Siemenstadt, but in the heart of the city itself, ringed about with the dwelling houses of workers in factories. If a bomb misses one of these factories, Berlin will scream out that the R.A.F. have bombed German workmen's homes. But, let there be no mistake, Berlin is a military target in the fullest sense of the term. For Berlin is a war city, and next week I shall give a list of some of the legitimate targets which fall within its boundaries and which lie around its outskirts.

ANOTHER AMERICAN INVASION

Supply of British Pilots Ample for Ferry Work

By A SPECIAL CORRESPONDENT

JUST how much truth there is in the statement that a large number of American pilots are being imported to this country in order to ferry military aircraft "from factory to airfield" is difficult to assess, but it is undoubtedly a fact that some have been so imported and that others are on the way. So much so that I have heard vague rumours that many of those who have already arrived in this country (attracted by useful salary promises) are being sent back as useless for the purpose. Others will no doubt do a good job of work—at considerable expense to the country.

Quite apart from the cost, which is probably trivial in comparison with those already being incurred in the prosecution of the war, surely those in authority must have considered the very bad effect that such a requested invasion must have on the sensitive minds of neutral countries. The conclusion to be reached by outside observers is quite a natural one and a most decidedly incorrect one: That our supply of pilots is dwindling.

In my opinion, this supply—at least for the purpose in question—has hardly yet been properly tapped. At the start of the war the Air Ministry quite naturally tended to choose only the very best for operational and other duties. The "28 to 48" V.R. scheme was introduced as a means of obtaining the services of those who had already put in a fair amount of flying. Some were accepted for flying duties and others were turned down because their standard of physical fitness was not quite up to the very high one demanded by the Central Medical Board. Some of those turned down for flying duties were offered and duly accepted ground duties. Others turned towards the civil organisation which is somewhat absurdly known as Air Transport Auxiliary—absurdly because their work is exclusively devoted to that of ferrying military aeroplanes and not to that of communication work, for which the pilots were originally enrolled.

An Anomaly

A great many of those who are now flying all types in all weathers and every day were told by the C.M.B. that they were "unfit for flying duties." Well, they are at least usefully employed, though in my opinion they should at least be given the chance of becoming a unit in, and not merely attached to, His Majesty's forces. They are doing work which is a great deal more useful and dangerous than that done by many men who are in fact wearing a uniform which is understood by the general public and which bestows certain obvious advantages when something has to be done.

But what of the hundreds who were turned away and accepted office work? And what of the hundreds who were too young to take advantage of the A.T.A. or of the V.R. arrangement? Many of these, with scores or even hundreds of flying hours to their credit, are waiting—either in the Air Force or in one of the other Services—for a chance to make use of their small but adequate experience. The A.T.A. has conclusively proved that ordinary club training can produce pilots capable of flying our most advanced military types and, more important, that the C.M.B.'s standards of fitness are quite unnecessarily severe except where operational flying is concerned—and even there I beg leave to doubt the decisions of those in authority.

We Have the Men

It is absolute nonsense to imagine that we are so short of pilots that it is necessary to turn to America for a bunch of men who are so comparatively inexperienced that they cannot find flying jobs in their own country. All that is required is a little combing-out and a little patience. Those who are out of practice or who have done very little flying in light aeroplanes can be given any number of Tigers, Magisters, Harts, Proctors, and so forth, on which to put in ferrying hours until such a time as they are ready to be converted to more advanced types.

These types are not difficult to fly in a straightforward manner and require only confidence and a certain amount of memorisation for their successful defeat. The original A.T.A pilots proved that—and they started with a distinct disadvantage in imagining the types were both difficult and dangerous. They tackled them with the certain feeling that it was only a matter of time before they would be found out. The early A.T.A. visitants at C.F.S., I am told, walked towards their machines with no less a feeling of impending doom than that possibly known to Nazi pilots who are now setting out on daylight bombing raids over this country. But nobody thought it was remarkable, no prizes were offered, and the aeroplanes were found to be as normal in their reactions as the smaller ones which the pilots had previously flown.

The hundreds of new pilots will require rather more careful nursing and rather more practice before being dashed into the air in advanced types—but they can do it just as well, while the old-timers cope with ultra-advanced types involving new and equally obvious difficulties. As a race, we take naturally to the air and nobody is going to tell me that it is necessary, advisable or expedient to turn to another nation for assistance in dealing with the best and safest aeroplanes in the world.

Wartime Engineering Training

THE College of Aeronautical and Automobile Engineering, Chelsea, London, S.W.3, has decided to rearrange its courses for the benefit of those who wish to qualify themselves for an engineering career in the R.A.F. and the Fleet Air Arm. Under the new arrangement of studies, service requirements are given first place, and the courses are so arranged that they may be interrupted for military service, should this become necessary, without greatly affecting their ultimate value to the student. In brief, what the college has done is to concentrate on military subjects, leaving the purely civil sections of the curriculum to be taken after the war.

During the war students may enter the college at any time after reaching the age of 16, and the preparatory course takes from 12 to 18 months, depending upon the time available to the student. Students who complete the preparatory course satisfactorily are awarded an intermediate certificate. Further particulars can be obtained from the secretary of the college.

As an item of interest it may be added that the College of Aeronautical and Automobile Engineering number three D.F.C.s and a V.C. among their former students, namely, Flying Officer C. A. C. Stone, Acting Flight Lieutenant M. N. Crossley, and Flying Officer W. H. Rhodes-Moorhouse, and quite recently a V.C. was awarded to Flight Lieutenant R. A. B. Learoyd, who was once a student in the automobile college.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

"BOOST"

Why Not Cable Launching?

I HAVE often marvelled at man's infinite capacity for taking himself seriously, and so may I for a short space, possibly with a beam in mine own eye, pull your leg in all seriousness on the matter of "Boost" in your August 8th issue.

As I see it, the problem is to get an aeroplane off the ground that won't—a similar problem to the one of the donkey that wouldn't. In this latter case the experts walloped the donkey, tried refuelling from the air by means of carrots in front of its nose, and ultimately lit a fire under it. This last idea, the forerunner of the rocket idea, worked, the donkey moved . . . just far enough to burn the cart.

Now, Sir, had I been there I should have backed my "Austin 7" up to the donkey, tied my tow ropes to the donkey's whiskers and driven off—either that donkey would have followed or I'd have pulled his nose off.

Mind you I claim no originality for this method, although I've launched many an aircraft by it and more still by winch and cable.

On reading your worthy journal from cover to cover, Dr. Lanchester informs me that all that is wanted is a force of half a ton to be exerted over 2,500ft., and now, Sir, may I, as most of us can only do who flew before the world went mad, reminisce on just a little more of your space. Just twelve months ago I helped launch an "aircraft" to 1,600ft. as recorded by its sealed barograph. True it was not of ten tons gross weight, but that is not our fault. If the fellows who built that winch could only have flown by winching a ten-ton aircraft they would have winched it or, like the donkey, pulled its nose off, and that would not have been their fault. If you should burn your fingers whilst Mr. Lanchester watches you through his very sensible telescope trying to launch ten tons of petrol and bombs with a rocket and still retain an interest in getting it unstuck, drop me a line and this will be the modus operandi.

A friend of mine will, one dinner hour, walk out of R.R.'s with a couple of Merlins under his coat (that's why he works there), others will pick up an old 30-ton tank to mount the Merlins on, and two or three others will while away the hours of their aerial fishing by stranding a few of H.M.'s balloon cables together (that were lost and were found). By much sweating, pushing, swearing and beer, the whole bag of tricks will be fastened together, and when finished will launch the "Queen Mary" in 2,500ft. if she can stand it.

Seriously, Sir, I cannot see the snags.

C. STERLING.

Assisting Both Take-off and Landing

BOTH Dr. Lanchester and Mr. Langley in discussing means for improving aeroplane performance consider the possibility of varying only one of the terminal operations. This has the effect of limiting the field for assisted take-off to cases like those of the bomber and the long-range machine where the loading is reduced before alighting. A technique of such limited application is surely, in the words of Dr. Lanchester, "an amelioration rather than a solution." A true solution of the high wing-loading difficulty would be the adoption of an operational technique which rendered assistance, not only for take-off, but for alighting also. It is landing rather than take-off which sets the limit to permissible wing-loading.

It is a very significant fact that the most heavily loaded birds are water-fowl. The reasons for this are obvious. Water is a medium capable of absorbing energy at high rates without imposing concentrated loads. It is not surprising, therefore, that the seaplane types are less subject to speed limitations during alighting than are land machines. With seaplanes it is the take-off case which presents the greatest difficulty, and in the case of the boat-seaplane, this condition necessitates a size and form of hull which renders it, aerodynamically, far inferior to the land machine. As soon as assisted take-off comes into the picture, however, the necessity for an enormous hull with steps and chines disappears. If the launching operation be effected by external means, a seaplane may be built with a hull not larger and aerodynamically equal to the fuselage of the land machine.

This combination of assisted take-off with water-alighting would permit higher wing-loading than could be used for land machines, and would not be restricted to bomber and long-range types. The method of flight refuelling is subject to the serious limitation that only fuel can be put down the hose. Extra passengers and freight cannot be added by this means.

It might be thought that the boat type would not be suitable for overland routes owing to the danger of a forced landing. This is not so. Few modern land aeroplanes succeed in making a forced landing outside an aerodrome and then leaving the landing place other than on a lorry. Except for a landing on smooth grassland, it is better to come down with the landing gear retracted. Obviously, the small strong hull and the high-wing arrangement of the flying boat would emerge from this kind of ordeal with far less damage than a land machine.

The operational technique here suggested implies the provision of "waterdromes" in place of present aerodromes. This should be not an additional expense but an economy since, owing to the greater retardation of water, a much smaller space could be used. Also a great deal of costless water is already available nearer to the great centres of population than aerodromes can be built. Most of the principal cities of the world are on waterways. Another not inconsiderable advantage is that such bases would be bomb-proof.

Not only would this method remove the limitations imposed upon wing-loading by land technique, but the complete elimination of landing gear and the concentrated loads which it imposes on the structure, would effect a great simplification and consequent cheapening of the airframe. Without the necessity for housing large landing wheels, wing-sections might be thinner and more efficient. The case for the v.p. airscrew loses much of its force when take-off is assisted. From the military standpoint, an undercarriageless aircraft would be far less vulnerable.

A launching device suited to this method of operation was described by me in *Flight* on July 4th last. F. W. KING.

New Malden.

DESIGNING FOR PRODUCTION

Neglected Woodworking Machinery

ALTHOUGH we are only sub-sub-contractors, the letter from your correspondent, Mr. G. S. Bird, of Leeds, in last week's issue interests us greatly, particularly two paragraphs. The first is that in which he states that parent aircraft producers have saved thousands by routing and spindling.

This may be, but have they realised that the great potential output by the woodworking trades on these two machines is at present lying dormant, remembering that this trade was skilled in the use of these machines and their essential jigs, in some form or another, long before the aircraft industry were aware of their value?

We contend that much delay and capital expenditure would be eliminated by the further employment of the woodworking mills at metal routing and spindling sub-contractors.

The other paragraph of interest to us is the last, with which we are in full agreement; we have found ourselves working in ignorance to fine limits where our usual woodworking trade limits would have been applicable.

London. HENRY & FARTHING, LTD.

An Air Ambulance Fund

OUR sister journal, the *Nursing Mirror*, has had the happy idea of launching a fund with the object of collecting money to buy an air ambulance. The fund is known as the British Nurses' Air Ambulance Fund, and it is hoped to collect the sum of £5,000. The *Nursing Mirror* has opened the fund with a donation of 100 guineas, and is defraying all expenses; every penny subscribed will go to the fund. Mr. K. A. Layton-Bennett, F.C.A., the eminent chartered accountant, has agreed to become honorary auditor to the fund. The Air Ministry has asked that if by the time the fund is completed, the R.A.F. already has its full complement of air ambulances, the money should be devoted to buying a Spitfire. One the other hand, if the fund should not reach the £5,000 mark, the Air Council will suggest an alternative use to which it can be put. Contributions should be sent to the British Nurses' Air Ambulance Fund, *Nursing Mirror*, Dorset House, Stamford Street, London. S.E.1.

HERE and THERE

Lord and Lady Trenchard chatting to Air Comdre. H. Peake, Director of Public Relations, at the R.A.F. Exhibition of War Photographs.

New European Air Routes

IT is reported that Germany and Spain have signed an agreement providing for the commencement of new air services.

Without Interest

THE Institution of Production Engineers has loaned to the Treasury without interest the sum of 1,000 guineas. This sum represents the excess of income over expenditure of the Institution for the financial year ended June 30, 1940.

British Order for Engines

IT is reported by *American Aviation* that the Warner Aircraft Corporation, of Detroit, will come into active production again following the receipt of an order for the manufacture of 250 of its Super-Scarab engines. These radial air-cooled engines of 165 h.p. are intended to power the small trainers being built by the Commonwealth Aircraft Corporation in Australia. Including the spare parts, the order is said to amount to $700,000.

Light Aircraft Manufacture

GENERAL MOTORS CORPORATION has announced that it is interested in the private owner type of aircraft cruising between 100 and 130 m.p.h. and has mapped out a developmental programme for the time when the market will be bigger and large-scale production more justified. They are not alone in their interest in this field of aviation, for William Stout, of the Stout Engineering Laboratories of Detroit, is starting to build a small two-seater of stainless steel with design adapted to quantity production.

The Ford interests are also spending large sums of money on aviation development not necessarily on the light-plane class, though Edsel Ford is reported to be interested in this type. It is believed that Henry Ford does not entirely share his enthusiasm.

Solar Navigator

A SOLAR navigator, of particular use to the photographic survey pilot, has been released for sale by the Fairchild Aviation Corporation. A combination of sun compass and drift sight, the solar navigator mechanically guides the pilot along parallel flight lines and so ensures a regular overlap to the photographs. The instrument is independent of changes of wind and magnetic variations. It must be mounted in the top of the fuselage so that the sun can fall on it. A gyroscope is part of its mechanism. It has already been used in mapping operations in America for some years.

Clare's Second Trip

AGAIN carrying among her passengers four American pilots, the trans-atlantic flying boat *Clare* completed her second return trip on August 20, arriving at Foynes at 11.35 a.m. The elapsed time between Botwood and Foynes was 13hr. 52min.

Destruction of France

THE French Air Ministry has issued a statement on the losses incurred by *l'Armée de l'Air* during the invasion of Holland, Belgium and France between May 10 and June 10. The statement says that 635 aircraft were destroyed, 306 of them being shot down and 229 being destroyed on the ground. The fate of the other 100 is not stated.

Factory and Men Available

WE understand from Gregory's, of Liverpool, that they have available for war work a factory of 65,000 sq. ft. of floor area, and a staff of 350 to work it. The factory is well lighted and heated, and there is an ample supply of power, steam, gas and water. It is not desired to let the factory, but to produce in it supplies needed for the carrying on of the war effort.

Morse Equipment Wanted

THERE is an urgent need for trained wireless operators in the R.A.F., and the Air Defence Cadet Corps can place cadets who, at the age of 17½, can send at the rate of 20 words a minute. But training equipment is somewhat difficult to obtain, and readers of *Flight* who wish to help are asked to send Morse keys, buzzers and headphones to the Secretary of the A.D.C.C. at the Air League of the British Empire, Kinnaird House, 1a, Pall Mall, London, S.W.1.

Women in Aircraft Production

AMONG the firms which have found it necessary to train women for aircraft production is Saunders-Roe, Ltd., Isle of Wight, who have found their school for male trainees, instituted some time ago, so successful that they have opened a branch for women.

The course provides for a short period of intensive instruction to fit non-skilled female labour to perform work in connection with the construction of the Lerwick flying boats for the R.A.F. No previous experience is required of the women trainees. They are simply required to do their utmost to adapt themselves to ruling conditions and become capable of assisting in the drive for increased production.

The course completed, the women pass from the school into the main factories where they are engaged on suitable work.

U.S. Air Base at Bermuda

GREAT BRITAIN has agreed to let the United States have an air base at Bermuda, and the Great Sound, an area of water of about five square miles and surrounded by reefs, will be used for this purpose.

The Changing C.A.A.

WITH its transfer to the Department of Commerce, the C.A.A. has now become the C.A.B., Civil Aeronautics Board. Robert H. Hinckley is now Assistant Secretary of Commerce, and his place as chairman of the C.A.B. is now taken by Harlee Branch, with Dr. Edward P. Warner as vice-chairman.

To fill the vacancy on the board, Dr. George Pierce Baker, formerly asscciate professor of transportation at Harvard University, has been appointed. C. B. Allen, formerly under Hardin on the Air Safety Board, has returned to the editorial staff of the *New York Herald Tribune*.

Numerous other resignations have occurred. R. S. Boutelle, director of the bureau of safety regulation, and Dr. E. S. Adams, who was chief of the medical section, have both gone. And Thomas Hardin, who was very well thought of in his position as chairman of the Air Safety Board, has now left after the abolition of the board, to become vice-president in charge of safety for Transcontinental and Western Air. Another man with an excellent record of work done for safety succeeds him in the corresponding position in the C.A.B. This is Jerome Lederer. We wish him every success in his important job.

Flight Computors

FOLLOWING the Librascope balance computor, which has so effectively facilitated centre of gravity calculations during the loading up of big aircraft that it is now only a matter of turning knobs on a dial and reading off c.g. position against a pointer, comes the "flight computor," also developed by the Librascope Company.

This instrument gives instant computation of every factor in a flight plan, reducing the time required for this calculation to less than one minute.

All that is necessary is to set pointer knobs to correspond to weather conditions and other known factors. These include wind velocity, wind direction, true course of flight, gross weight, time elapsed, pressure altitude, free air temperature, horse-power and engine r.p.m. As these knobs are set, they automatic-

HERE and THERE (Continued)

ally move the recording dials a mathematically predetermined distance.

These recording dials are calibrated to show total distance, true course, ground speed, drift angle, indicated air speed, total fuel consumption, manifold pressure required and engine B.M.E.P.

The flight can be figured right up to the moment of take-off, for most efficient operation under existing conditions. As flight conditions change, the pilot resets his instrument, and instantly knows what corrections to make for maximum range, minimum fuel consumption and exact time of arrival. Orders are now being filled for American Airlines, the U.S. Army and Navy, Lockheed Aircraft, and Transportes Aereas Centro Americanos. These operations will include a variety of engines and planes.

The company also states that balance computors have been sold to 31 airlines, and also for military use on the Lockheed Hudsons in Australia. They will be fitted as standard on the Lockheed Lodestars.

Shock Absorbers

TWO misprints occurred in the article by Mr. R. Hadekel in *The Aircraft Engineer* Supplement in our July 25 issue. In the list of symbols on page 30 the last line should have read $r = 1$ for wheel mounted directly . . ., instead of $r = l$.

In the inscription to Fig. 2 P = W' should have read P = 3.6 W'.

U.S. Aircraft Expansion

THE ECONOMIST gives an index of the rate at which the U.S. aircraft manufacturing industry is expanding its man-power. The index (which takes the years 1923-25 as 100) quotes the figure of 968 for March, 1939, and 1,075 for April. By September the index had risen to 1,512, while for April, 1940, it had reached 2,101. This indicates more than a two-fold expansion in the year.

Radio-controlled Flares

FOR defining the "runways" of flying-boat bases, fluorescent lamps mounted on rubber buoys have been developed by Westinghouse Electric and Firestone Tires in conjunction with the Civil Aeronautics Board in U.S.A. Each buoy contains a metal housing, inside which is a radio receiver for remote control, batteries for lighting the fluorescent lamps and control equipment for making the flash.

The fact that the lights can be operated from the shore by radio control allows any one of several runways which may be laid out to be selected for use according to wind conditions just before the incoming flying boat arrives. The lamps are available in red, gold and green colours. The buoys are made in two sizes, the larger being for permanent installation while the other is small enough for transportation by air to any temporary base which may be in use at the time.

Soviet Airline to Far North

A REGULAR passenger and mail service from Moscow to the Chukotsk Peninsula was recently opened by the Polar Aviation Department of the Northern Sea Route Administration. The route runs over the northern coasts of the U.S.S.R. to the Anadyr district, over regions lying mainly beyond the Arctic Circle. All-metal flying boats having accommodation for 25 passengers and a crew of five are used. (Cape Chutotski and the Gulf of Anadyr lie at the extreme western tip of the U.S.S.R. on the Bering Strait, so that the airline is of considerable length and lies over country with severe weather conditions.)

Small Radio Transmitter-Receiver

IT is reported that Amalgamated Wireless of Australia has developed a small and lightweight radio set which is both a transmitter and a receiver. Weighing less than 21lb., it is intended for use in small aircraft, and the aeroplane operating the Flying Doctor service at Cloncurry is to have one installed. The set can be used for communication on the ground after a forced landing.

Photo-Electric Bomb Sight?

IN the only bombing attack on Paris, the European representative of the Bendix Aviation Corporation described the German aeroplanes as coming over at such height that they were invisible to the naked eye, says a report in *Time* for July 29. He believed there were 250 aircraft in the attack on the Citroen car factory outside Paris, said to be estimated by the number of bombs they dropped.

"Their accuracy was terrific. Of all the bombs dropped . . . the majority plunked right into the factory." If this statement is literally correct, it provides some evidence for the speculation which the article contains that the Germans may have developed a bomb-sight which does away with the necessity of pressing a bomb-release button and substitutes a photo-electric cell built into the bomb-sight to let the bomb go when the sight is on the target.

True Story

OFFICIAL forms are sometimes rather inadequate means of expressing one's self, but a certain duty pilot in the R.A.F. was unable to let this deter him. A young trainee was sent off on his first solo cross-country in a Tiger Moth. Approaching the aerodrome at the end of the first leg of the flight, he throttled down for the glide in. But his comparative inexperience caused him to undershoot, and a line of small trees along the aerodrome boundary began to loom large in front of him. An unfortunate attack of paralysis of the throttle hand occurred at this moment and the Tiger glided in to touch down somewhat in front of the trees. The resulting bounce demanded action of some sort which turned out to be the opening of the throttle, and the aeroplane cleared the trees, after which, with closed throttle, it settled down in a three-pointer on the aerodrome just inside the trees.

The trainee afterwards applied to the duty pilot for his signature to take back as evidence of arrival at that aerodrome. As he filled in the official form, the duty pilot came to the place where he must cross out the two which do not apply: *Landing—Good, Fair, Bad.* After a short hesitation, he crossed out all three in favour of his own description—*Blue-pencil amazing.*

"Aircraft Production"

SOME idea of the immense activity in aircraft works is provided by the September issue of our sister journal *Aircraft Production*, published this week, price 1s. 6d. Among the contents is an article describing and illustrating jig design for aircraft, with particular reference to the comprehensive tooling equipment employed for the Blackburn "Skua." There is also a feature dealing with the rolling of airscrew blanks, another describing a modern all-electric factory canteen, and a feature devoted to the production methods of Hepworth and Grandage, Limited, in the manufacture of piston rings and gudgeon pins. Among many new machine tools specially adapted for aircraft work are a series of specialised machines for milling, drilling and riveting wing spars, which owing to their length and straight line design have not hitherto been easy to handle. Another article describes methods of checking quality of production in manufacture as practised in Germany.

The succeeding issue of *Aircraft Production* for October will have as its special feature a review of the production methods employed in the manufacture of the Airspeed Oxford twin-engined low-wing monoplane.

At the Memorial Service held in Westminster Abbey for the Australian Cabinet Ministers who lost their lives in a flying accident. Major-General Winters, G.O.C. Australian Army in England, and Gp. Capt. Macnamara, Australian Liaison Officer, leaving the Abbey.

Another Record

IN an announcement issued last Monday, Lord Beaverbrook paid tribute to the men and women of the aircraft industry. "These brave defenders of the liberties of Britain," the announcement stated, "ignoring air raids and indifferent to enemy attacks, have provided for the Royal Air Force in the last week more fighters and more bombers than ever before in the history of aviation."

H. M. The King, accompanied by General Sikorski, inspecting two squadrons of the Polish Air Force.

SERVICE AVIATION

D.F.C. and D.F.M. to Remain

THE SECRETARY OF STATE FOR AIR, Sir Archibald Sinclair, replying to a question in the House of Commons, said "that whether the D.F.C. and the D.F.M. should be replaced by one decoration, for which both officers and men should be eligible, had been considered by the committee on the Grant of Honours, Decorations and Medals in Time of War, which recommended that no change should be made."

"There was no snobbish distinction, nor was the D.F.M. in any way inferior in honour to the D.F.C."

R.A.F. Display

THE exhibition of Royal Air Force War Photographs, which was opened on Friday last at the Grafton Galleries of the Building Centre, New Bond Street, W.1, will remain open for six weeks.

A very high standard of photographic art and interest has been achieved, and it should go far to satisfy the public thirst for knowledge of the most spectacular, if the most junior, Service.

Sections deal with Fighter Command, Bomber Command, Training Command, Observer Corps, aircraft production, and many other phases of our air war effort. With some knowledge of the problems involved, we offer our congratulations to Mr. Francis, Mr. Gibb-Smith, and the able staff under their command at the Photograph Department of the Ministry of Information, for an excellent display.

Palestine Recruiting

OWING to the great response to the request for recruits from Palestine and Transjordan for the R.A.F., local enlistment has been temporarily suspended. Recruiting for Army service remains open.

Telegrams to R.A.F. Abroad

THE Air Ministry announces that, as from August 12th, 1940, facilities will be provided by which the officially nominated nearest relative or friend of officers and men serving in Malta, Egypt, Palestine, Cyprus, Anglo-Egyptian Sudan, Aden and South Africa, will be able to send to them private telegrams of an urgent character at ordinary inland rates. These concession telegrams will be limited to not more than two a month for any one sender.

These must be handed in at a post office in the United Kingdom on a special form to be obtained on application in writing. In the case of next-of-kin of officers, application should be made to the Under-Secretary of State (S 7B (2)), Air Ministry, Kingsway, London, W.C.2. In the case of applications by next-of-kin of other ranks, letters should be addressed to the Air Officer Commanding, Record Office, Royal Air Force, Ruislip, Middlesex. In both cases the words "cable form" should be written in the top left-hand corner of the envelope.

Care should be taken to mention the service number, rank, name and unit of the officer or man concerned. Applicants are asked to enclose an addressed envelope for reply. It should be obtained in the manner described above and cannot be obtained at a post office. The use of the special-concession telegram forms is to be limited to messages of an urgent and private nature. Telegrams are to be addressed in the usual manner, i.e., service number, rank, name, squadron or unit, station, country in which the squadron or unit is serving. The address will count only as five words, no matter how long it may be, but the text of each message should not normally exceed twelve words. Telegrams will be charged for at the usual inland rates.

Royal Air Force Awards and Official Announcements

Flt. Lt. R. A. B. Learoyd who recently won the V.C. for bravery whilst bombing the Dortmund-Ems canal.

Awards

THE KING has been graciously pleased to approve the undermentioned appointment and awards, in recognition of gallantry displayed in flying operations against the enemy:—

APPOINTED A COMPANION OF THE DISTINGUISHED SERVICE ORDER.

Act. Flt. Lt. J. A. Pitcairn-Hill, D.F.C. Act. Flt. Lt. Pitcairn-Hill, D.F.C, was born at Prinlaws, Leslie, Fife. He became an aircraft apprentice in 1932 and was appointed to a cadetship at Cranwell in 1935. He became Pilot Officer in 1937, Flying Officer in 1939 and Acting Flight Lieutenant ten months later.

AWARDED THE DISTINGUISHED FLYING CROSS.

P/O. H. V. Matthews. On a night in August, Flt. Lt. Pitcairn-Hill led a formation of aircraft, one of which was piloted by P/O. Matthews, in a low-flying attack on the Dortmund-Ems Canal. In spite of intense enemy opposition over the target area, in which all aircraft were seriously damaged and two were shot down, these officers carried out a successful attack from 150 feet precisely at zero hour. The timing of this difficult operation was dependent on the skill, judgment and personal resolution of Flt. Lt. Pitcairn-Hill, who has at all times displayed outstanding gallantry, skill and devotion to duty. P/O. Matthews, by his courage, determination and skill has at all times set an excellent example.

P/O. C. F. Gray. Since May, 1940, P/O. Gray has flown continuously with his squadron on offensive patrols. He took part in numerous engagements against the enemy throughout the Dunkirk operations, and subsequently throughout intensive air operations over the Kentish coast and in protection of shipping in the Channel. He has shot down four Messerschmitt 109s and, it is believed, destroyed a further four. He also assisted in destroying one Messerschmitt 109 and one Dornier 215. His example, courage and determination in action have contributed materially in maintaining the high morale of his squadron.

P/O. J. K. U. B. McGrath, A.A.F. In May, 1940, during a patrol over Arras, P/O. McGrath destroyed a Messerschmitt 109. A few days later, near Dunkirk, he shot down a Messerschmitt 110. Since then he has destroyed a further three enemy aircraft and possibly another seven. He has displayed great courage and determination.

P/O. H. M. Stephen, R.A.F.V.R. Since May, P/O. Stephen has flown continuously with his squadron on offensive patrols, and taken part in numerous engagements against the enemy throughout the Dunkirk operations. He has also been engaged protecting shipping in the Channel and has taken part in intensive air operations over the Kentish coast. On August 11, in company with his squadron, P/O. Stephen participated in four successive combats against large formations of enemy aircraft over the Thames Estuary and Channel, and during these engagements he shot down five enemy aircraft. He has now destroyed a total of twelve enemy aircraft and has always displayed great coolness and determination in pressing home his attacks against the enemy.

Ruhral Transport: A Wellington being prepared for the usual night trip to Germany. Note the new shape of the camouflage painting to defeat the searchlights.

P/O. P. C. F. Stevenson. This officer has flown continuously with his squadron since May, 1940. He participated in the Dunkirk operations and has since been engaged throughout the intensive air operations which have occurred whilst protecting shipping in the Channel and Thames Estuary. He has destroyed three enemy aircraft and assisted in the destruction of others. On two occasions this officer has been forced to abandon his aircraft by parachute on account of enemy action, but this has merely increased his determination to engage the enemy on every possible occasion. His coolness, courage and spirit are of the highest order.

Act. Flt. Lt. L. M. Gaunce. This flight commander has displayed excellent coolness and leadership since the return of the squadron to England. In July his flight took part in resisting an enemy air attack on Dover, when three of our aircraft were attacked by forty Junkers 87s. At least two of the enemy aircraft were shot down. Flt. Lt. Gaunce has shot down three enemy aircraft since returning to England.

F/O. P. Collard (since reported missing). During operations in France, and in particular during a period in May, this officer took part in almost every patrol undertaken by the squadron and destroyed two enemy aircraft. Since his return to England, F/O. Collard has continued his excellent work and has destroyed a further four enemy aircraft.

P/O. P. H. Hugo. P/O. Hugo has displayed great keenness to engage the enemy on every possible occasion. During June and July he destroyed five enemy aircraft.

AWARDED THE DISTINGUISHED FLYING MEDAL.

Sgt. J. H. Lacey. Sgt. Lacey has taken part in numerous patrols against the enemy. He has displayed great determination and coolness in combat and has destroyed six enemy aircraft.

Sgt. L. S. Millen. Sgt. R. H. Carr. In August, Sgt. Millen was the pilot of an aircraft detailed to attack a target at Brest. During the attack he was severely wounded by anti-aircraft fire and throughout the remainder of the flight was unable to use his left arm. Sgt. Carr, the observer, then took the pilot's seat in order that he could apply an improvised tourniquet. During this operation he also controlled the aircraft, and under these great difficulties undoubtedly saved the pilot's life. Again changing places, Sgt. Millen returned to the controls and, although he collapsed several times on the way back, he succeeded in bringing his aircraft safely to a home station. Both airmen displayed great courage, determination and devotion to duty of a high order.

Roll of Honour

Casualties sustained by the Fleet Air Arm in H.M.S. *Glorious*, the loss of which has already been announced.

OFFICERS.

KILLED.

Mr. L. P. Ayres, Wt. Air Mech., R.N.; Act. Sub-Lt. (A) J. M. Franklin, R.N.; Sub-Lt. (A) J. F. Shillitoe, R.N.V.R.

MISSING.

Lt. (A) G. H. J. Feeny, R.N.; Lt. (A) B. P. Hart, R.N.; Lt. (A) R. J. B. Miles, R.N.; Proby. Tempy. Sub-Lt. (A) E. A. Phillips, R.N.V.R.; Sub-Lt. (A) J. H. Radcliff, R.N.; Sub-Lt. (A) G. P. Ritchie, R.N.

R.N. RATINGS.

KILLED.

Bridges, P., Ldg. Air Fitter (E); Hill, W. H., Act. Ldg. Airman (A.G.3); Longley, T. W., Air Art. 4th Cl.; McLellan, P. M., Ldg. Airman (A.G.2).

MISSING.

Aldington, H. S., Air Mech. (E); Baldwin, G. C., Air Mech. (O); Ball, J., Air Mech. 2nd Cl. (O); Beck, N. A., Air Fitter (E); Bloomfield, A. C., Air Mech. (O); Booth, P. R., Air Mech. 2nd Cl. (A); Brett, B., Ldg. Airman (A/A.G.3); Brompton, J. K., Air Mech. 1st Cl. (L); Burns, W. H., Naval Airman 1st Cl. (A/A.G.3); Cambridge, F. S., Air Fitter (A); Chapman, W. R., Air Mech. 1 (A); Collings, J., Air Mech. (A); Cooke, L., Air Mech. 2 (L); Coulter, T., Air Mech. (E). R.N.S.R.: Crichton, A. W., Act. Ldg. Airman (A/A.G.3); Davis, L. F., Air Mech. 2 (O); Duckworth, W. L., Air Mech. 2 (O); Eames, P. L., Air Mech. 2 (E); Felkin, J. H. C., Air Fitter (E); Finch, P. L., Air Fitter (E); FitzGerald, J. S., Act. Air Artificer 4th; Flegg, A. J., Air Fitter (E); Franck, D. G., Air Fitter (A); Gayne, C. J., Air Mech. 2 (A). R.N.S.R.: Grimmer, J., Air Mech. 1 (O); Haddrell, W. G., Air Mech. (L); Harper, E. W., Air Mech. 2 (L); Harvey, J. W., Air Fitter (A); Heath, J., Act. Ldg. Airman (A/A.G.3); Holroyd, T., Air Mech. (O); Hope-Johnstone, N. D., Air Fitter (A); Hounsell, R. E., Air Mech. (E); Houldsworth, J., Ldg. Airman (A.G.3); Jennings, J., Air Mech. 1 (E); Jones, B. R., Air Mech. (E); Kelleher, R., Air Fitter (E); Kellett, S., Air Mech. 2 (O); Law, R. J., Air Mech. (F); Lawton, S., Air Mech. 2 (L); Lewis, F. G., Air Mech. 1 (O); Lowe, J. W., Air Mech. 2 (E); Mandsley, J. F., Air Mech. (A); May, G. R., Air Fitter (E); Morris, G. H., Air Fitter (E); Morton, D. C., Naval Airman 1st Cl. (A/A.G.3); Mountain, A., Air Fitter (A); Nevitt, W. J., Air Mech. 2 (L); Osler, L., Air Fitter (O); Puntis, E. H., Act. P.O. Airman (A.G.2); Roberts, O. H., Air Mech. (O); Roberts, R., Air Mech. (E). R.N.S.R.: Ryder, F. J., Air Fitter (E); Sexton, R. J., Air Mech. 2 (A); Siemon, C. E., Air Mech. 1 (A); Smith, D. G., Ldg. Air Fitter; Smith, T. P., Air Fitter (A); Tebbutt, L. D., Air Mech. 2 (E); Thomas, S., A.B. (Fabric Worker); Thompson, W. N., Ldg. Air Fitter (A); Todd, R., Air Fitter (A); Tooze, T. S., Air Mech. (A); Vaughan, W. H., Air Mech. (O); Wa ren, W. B., Air Mech. (E).

Air Ministry Casualty Communique No. 43.

THE Air Ministry regrets to announce the following casualties on various dates. The next-of-kin have been informed.

KILLED IN ACTION (WHILE FLYING IN OPERATIONS AGAINST THE ENEMY).—P/O. J. F. E. Andrews, 41648; Sgt. R. D. Baker, 518293; Sgt. R. Beales, 742726; P/O. J. Body, 73023; P/O. F. W. Cale, 42104; P/O. C. F. Cardnell, 80807; Sgt. E. J. Clarke, 624944; Sgt. R. J. Cocks, 642593; Sgt. E. D. Farmer, 565737; F/O. B. M. Fisher, 72332; P/O. F. S. Gregory, 81044; P/O. R. E. Houseman, 77936; Sgt. R. Jolly, D.F.M., 523203; Flt. Sgt. N. T. Phillips, 365324; Sgt. R. D. Ritchie, 745702; Act. Sgt. J. J. Scott, 755254; Sgt. G. A. Sewell, 530961; Sgt. J. H. Swift, 644387; Act. Wing Cdr. J. J. Watts, 32152; Sgt. A. Winstanley, 617595.

PREVIOUSLY REPORTED "MISSING, BELIEVED KILLED IN ACTION," NOW PRESUMED "KILLED IN ACTION."—L.A/C. G. Peterson, 520852; A/C.2 L. H. Trumay, 531133; A/C.1 R. J. Webber, 569704.

PREVIOUSLY REPORTED "MISSING," NOW PRESUMED "KILLED IN ACTION."—Cpl. B. A. Kidd, 800235; Sgt. A. L. Long, 755181; Act. Sgn. Ldr. J. M. Wells, 90081.

PREVIOUSLY REPORTED "MISSING, BELIEVED KILLED IN ACTION," NOW REPORTED "KILLED IN ACTION."—Sgt. G. W. J. Juby, 514904; Sgt. A. S. Pearce, 580805; Sgt. A. E. D. Twanley, 580573; L.A/C. L. A. Westcott, 545537.

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "KILLED IN ACTION."—Sgt. W. F. Anderson, 532047; Sgt. W. J. Barrett, D.F.M., 580566; P/O. C. N. Buist, 42690; Sgt. R. Burnett, 619744; P/O. J. R. Cronan, 42109; Sgt. H. C. Davies, 523102; Sgt. H. T. Denison, 552584; Sgt. R. L. J. Dutton, 547594; Sgt. O. S. Gander, 552107; Sgt. H. A. F. Giblin, 523945; A/C.1 B. Gill, 621946; Sgt. G. Greenwood, 566263; F/O. J. R. Guthrie, 33314; Sgt. C. Hanlon, 628296; Sgt. W. C. Harding, 580426; A/C.1 W. E. Harding, 627362; Sgt. K. H. Harris, 530943; Sgt. R. Houghton-Brown, 581100; P/O. C. J. T. Jones, 70805; Sgt. D. Leishman, 751309; Sgt. G. E. Little, 547515; L.A/C. P. L. Lloyd, 551596; P/O. A. S. Luxmoore, 40628; F/O. L. H. McFarlane, 39545; Sgt. R. I. L. Mackenzie, 580459; Sgt. W. Martin, 748313; P/O. A. R. Mathias, 41603; P/O. J. G. Mitchell, 41862; L.A/C. W. G. Newton, 551758; Sgt. G. Nichols, 624403; Sgt. E. H. Paul, 565282; Sqn. Ldr. H. Pilling, 29178; Sgt. T. C. Prescott, 740264; Sgt. C. E. Read, 580828; P/O. D. Redmayne, 41206; P/O. M. E. Ryan, 42154; Sgt. A. H. Smith, 550966; Sgt. J. A. Smyth, 565748; Sgt. W. A. Spickett, 516666; Sgt. L. H. Stride, 546871; Sgt. V. J. Swallow, 540806; Sgt. C. N. Webster, 631464; F/O. A. W. A. Whitehead, 70731; P/O. G. M. Wyatt, 40563.

"WOUNDED OR INJURED IN ACTION."—Cpl. D. N. Allfree, 519908; F/O. G. N. S. Cleaver, 90135; L.A/C. R. S. Diss, 542479; P/O. A. G. Donahue, 81624; Flt. Lt. W. J. Harper, 40110; Sgt. D. Haywood, 580296; P/O. A. G. Page, 74709; P/O. K. Schadtler-Law, 42267; Act. Flt. Lt. E. B. I. Smith, 90540; F/O. A. B. Tucker, 70685; P.O. D. R. Turley-George, 41336.

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "WOUNDED OR INJURED IN ACTION."—Cpl. J. Judd, 514945.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—P/O. P. F. Kennard-Davis, 42348; Sgt. G. R. Pope, 746774.

"MISSING, BELIEVED KILLED IN ACTION."—P.O. A. J. G. Bisson, 41774; P/O. R. K. Felstead, 41786; F/O. D. N. Grice, 70266; Sgt. F. J. Keast, 801399; A/C.1 J. B. W. Warren, 628804; L.A/C. D. J. R. Wilson, 527234; Sgt. N. F. Wilson, 747962; Sgt. A. D. Wright, 747992.

MISSING.—Sgt. R. Abel, 569202; P/O. C. J. D. Andréae, 70018; P/O. D. G. Ashton, 76574; Sgt. E. D. Baker, 740057; P/O. G. M. Bardolph, 78695; Sgt. R. F. Batho, 580629; Sgt. A. J. Baum, 581137; Sgt. J. M. Beattie, 619327; Sgt. B. W. Beaumont, 744955; Sgt. J. K. Blazier, 746887; Sgt. A. E. Bowes, 521360; F/O. G. R. Branch, E.G.M., 90137; Sgt. F. J. C. Brown, 755817; P/O. D. O. M. Browne, 41234; Sgt. S. L. Butterfield, D.F.M., 563441; P/O. F. N. Cawse, 80543; A/C.1 J. Chapman, 614035; P/O. D. G. Cobden, 41552; P/O. P. J. Coleson, 42695; F/O. P. Collard, D.F.C., 90402; P/O. P. W. Comely, 41831; Sgt. L. C. Cooke, 523013; P/O. J. H. H. Copeman, 41257; P/O. R. M. Coulman, 41557; Sgt. G. H. Coulton, 619184; Sgt. K. W. Crane, 526095; P/O. J. Cruttenden, 40395; F/O. B. W. J. D'Arcy-Irvine, 72500; Sgt. J. H. Davies, 742518; P/O. H. L. N. Davis, 72988; F/O. R. S. Demetriadi, 90145; P/O. F. G. H. Dench, 42487; P/O. W. G. Dickie, 80541; P/O. L. T. Dixon, 42111; P/O. R. B. Forbes, 41391; Sqn. Ldr. J. B. Fyfe, D.F.C., 24208; F/O. J. Gillan, 37675; Sgt. T. E. Girvan, 552188; Sgt. G. Gledhill, 742857; F/O. R. L. Glyde, D.F.C., 39933; P/O. A. Gordon-Peiniger, 40904; P/O. R. F. Gower, 40693; Sgt. S. Grant, 539039; Flt. Lt. N. M. Hall, A.F.C., 33166; Sgt. C. Hamilton, 581214; P/O. E. A. Harris, 77934; P/O. J. H. Harrison, 76577; Sgt. S. D. Hill, 741410; Sgt. E. Hopperton, 625352; Sgt. L. R. Isaac, 749158; Flt. Lt. R. V. Jeff, D.F.C., 39235; Sgt. P. W. N. Jelley, 751725; Sgt. R. J. Jennings, 565910; Sgt. J. Jones, 638740; P/O. J. S. B. Jones, 33467; Sgt. J. A. Kearey, 517634; Sgt. V. R. T. Land, 905836; F/O. D. C. Maccaw, 36139; Sqn. Ldr. R. G. S. Morgan-Weld-Smith, 05224; P/O. G. G. K. Nolan, 417127; P/O. J. R. S. Oelofse, 42519; Sgt. J. M. Oliver, 700059; Sgt. F. F. Parvin, 58119; Sgt. T. A. Peach, 581241; P/O. H. G. R. Pirie, 42077; Sgt. E. H. Platts, 633213; Sgt. M. A. Prentice, 812244; Sgt. T. O. Price, 638145; Sgt. P. Pryde, 551852; Sgt. E. S. Quinn, 611465; Sgt. K. G. R. Rew, 526687; P/O. R. Roberts, 90397; Sgt. J. H. Saville, 745096; P/O. L. A. Sears, 42805; P/O. H. C. Sheldon, 42155; P/O. D. C. Shepley, 33464; Sgt. F. C. Shook, 581534; Sgt. P. B. Sim, 742609; P/O. D. N. F. Smith, 79524; Sgt. K. R. Smith, 754895; P/O. N. H. H. Smith, 42470; P/O. J. L. Smithers, 90420; Flt. Sgt. A. R. Storrow, 565309; Sgt. S. G. Stuckey, 516334; Flt. Sgt. J. H. Tanner, 565125; Sgt. G. D. Tennant, 550847; A/C.1 J. Townsley, 552596; Flt. Lt. D. E. Turner, 33254; Sgt. A. J. Underwood, 626950; Flt. Sgt. T. M. Vaughan, 890381; P/O. E. C. J. Wakeham, D.F.C., 41883; Act. Flt. Lt. S. C. Walch, 40065; Sqn. Ldr. R. N. Warwell, 37140; Flt. Lt. R. D. G. Wight, D.F.C., 33147; Sgt. G. N. Wilkes, 741715; P/O. R. R. Wilson, 41513; Act. Flt. Lt. L. C. Withall, 39361; Sgt. W. G. W. Younger, 567875.

"MISSING, BELIEVED KILLED ON ACTIVE SERVICE" (WHILE ENGAGED ON NON-OPERATIONAL FLYING DUTIES OR ON THE GROUND THROUGH ENEMY ACTION).—Act. Sgt. E. D. Barratt, 504903; Sgt. G. H. McCrory, 580666; A/C.2 E. J. Toy, 572787; Act. Sgt. M. L. Tully, 564904.

"KILLED ON ACTIVE SERVICE."—Sgt. E. C. Adams, 745769; Sgt. A. G. Allen, 648865; Sgt. D. F. Alves, 550539; A/C.2 H. G. A. Peales, 905638; L.A/C. S. H. Bell, 742519; Sgt. W. L. Colls, 758029; P/O. G. G. Crawford, 41473; Sgt. A. S. Dalgress, 742697; Sgt. A. J. Fetherstone, 743733; Sgt. D. A. Gibbs, 755157; Sgt. W. C. Goldsmith, 648517; P/O. J. F. Harper, 77386; Sgt. L. C. R. Hill, 956258; Sgt. F. H. Hull, 755799; P/O. R. T. Kean, D.F.C., 41295; Sgt. C. W. McKenzie, 516750; Sgt. D. Mannion, 627225; Flt. Lt. F. P. Mortimer, 37521; Sgt. W. Nelson, 908425; Sgt. J. M. Oxtoby, 754620; P/O. D. P. Rustom, 42079; Sgt. S. Sanderson, 748826; Sgt. C. Smith, 903160; Sgn. Ldr. I. H. D. Walker, 33073; A/C.1 R. C. Wheeler, 533650; P/O. L. Williams, 40451; Sgt. R. F. Wilson, 755655.

PREVIOUSLY REPORTED "MISSING, BELIEVED KILLED ON ACTIVE SERVICE." NOW PRESUMED KILLED ON ACTIVE SERVICE.—F/O. P. Folkes, 39076.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. F. A. Andrews, 965408; P/O. J. K. Astin, 41650; Act. Flt. Lt. T. D. Atkinson, 44216; Flt. Sgt. C. Carter, 515475; Sqn. Ldr. A. E. Dark, 26051; P/O. R. F. A. J. De Burlet, 42811; Sgt. T. P. Garner, 742720; Sgt. A. C. Maclean, 745032; Sgt. T. Reynolds, 740873; P/O. D. M. A. Sims, 42364; Sgt. W. G. Vosper, 514865.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. R. D. Bailey, 746776; Sqn. Ldr. J. H. Bycher, 36008; Sgt. J. Grant, 651489; Sgt. J. W. Mallard, 564260; Sgt. E. C. J. Wilson, 745647.

SERVICE AVIATION (CONTINUED)

SERVICE AVIATION (CONTINUED)

DIED ON ACTIVE SERVICE.—L. A/C. C. Anthony, 623211; A/C.2 W. E. H. Barker, 1301188; Act. Flt. Lt. C. H. Bull, 37594; A/C.2 A. J. Butchart, 1103630; A/C.1 R. S. Davis, 535351; Sgt. G. N. Fraser-Luckie, 745633; Cpl. E. S. Ginns, 540014; A/C.2 L. P. Lloyd, 799681; Cpl. H. Moore, 351185; A/C.1 T. F. Saunders, 124217; A/C.2 D. Stewart, 991111.

PREVIOUSLY REPORTED "MISSING, BELIEVED KILLED ON ACTIVE SERVICE," NOW REPORTED "SAFE."—Sgt. J. Hood, 902982.

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "SAFE."—A/C.1 G. R. Dunthorne, 618587; A/C.1 V. Wilson, 751647.

PREVIOUSLY REPORTED "MISSING, BELIEVED KILLED IN ACTION," NOW REPORTED "PRISONER OF WAR."—Sgt. A. Williams, 580502.

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "PRISONER OF WAR."—Sgt. D. A. Adams, 741918; Sgt. G. A. Allison, 552647; Sgt. A. Avery, 581257; Sgt. C. A. G. Burran, 552645; Sgt. J. P. Caldwell, 626021; Cpl. A. L. Cartwright, 8823; A/C.1 N. P. Donnelly, 541074; A/C.2 E.P. Doolin, 640566; P/O. S. G. Esson, 40376; Sgt. A. E. Farrow, 511965; Flt. Lt. E. C. S. Fewtrell, 37673; Act. Flt. Lt. D. A. ffrench-Mullen, 33245; Sgt. S. Fieldhouse, 630209; P/O. P. C. Gaylard, 41995; P/O. C. S. Greenaway, 43638; Sgt. G. J. W. Grimson, 631689; Sgt. G. C. G. Hawkins, 746982; A/C.1 G. Hemsworth, 541742; Sgt. H. F. Heritage, 524595; Sgt. G. W. H. Kendall, 563559; L. A/C.1 G. F. Lewis, 533360; Sgt. R. C. Lidstone, 747853; A/C.1 D. A. Macdonald, 552525; A/C.1 J. McMurray, 965010; Sgt. A. R. Morris, 528047; P/O. J. P. North-Lewis, 73546; F/O A. D. Panton, D.F.C., 33331; P/O. R. C. L. Parkhouse, 33575; P/O. D. I. Pike, 43479; A/C.1 R. Shuttleworth, 626487; Sgt. H. W. J. Smith, 812199; L.A/C. W. B. Smith, 566173; L.A/C. J. G. Taylor, 529188; Sgt. R. C. Trowbridge, 650858; Sgt. J. D. Wicks, 751253.

Prisoners of War

THERE is evidence that the German authorities are exploiting the natural anxiety of the next-of-kin of officers and men in the forces who have been posted as missing to cause them to listen to German propaganda in the hope of obtaining news of their relatives. To avoid any need of doing this arrangements have been made whereby the names and particulars of British prisoners announced in German broadcasts will be recorded by the B.B.C. and passed to the Air Ministry, who will then inform the relatives and next-of-kin immediately.

The relatives and next-of-kin of officers and airmen can be assured that no such announcement will be missed.

Following is the latest list of British prisoners of war in enemy hands, as received from German and Italian sources:—P/O. J. Brockway, Shadwell, Norfolk; Flt. Lt. R. A. Ellin, Charing, Kent; P/O. H. Clark, Manitoba, Canada; P/O. V. Parker, Townsville, N. Queensland; P/O. R. Hardy, Charing Cross Road, London, P/O. A. Cordet, Merrickville, Ontario; P/O. Biden, no address given, wounded and in hospital at Aalborg, Denmark; Flt. Lt. Syms, no address given, wounded and in hospital at Aalborg, Denmark; Sgt. G. Harris, Redditch, Worcs; Sgt. F. Wilkes, Beachcroft Road, Plymouth; Sgt. J. Brooks, Kemp Town, Brighton; Sgt. J. Bristowe, Tulse Hill, London; Sgt. G. Thomas, Ambersley, Droitwich; Flt. Sgt. F. Hotchkiss, Buxton, Derbyshire; Sgt. G. Macreary, Falkirk, Scotland; Sgt. K. Wright, Wellgate, Rotherham, Yorks; Sgt. S. Croft, Alleyfield Road, Birmingham, 23; Sgt. V. J. Dance, Andover, Hants; Sgt. Oates, wounded and in hospital at Aalborg, Denmark; Flt. Lt. A. R. Mulligan, 2, Waterden Road, Guildford; Flt. Lt. B. F. A. Skelton, Foxhill, Nr. Ipswich; Sub. Lt. F. E. Paul (saved by German rescue plane), no address given

P/O. G. R. Humphries, no address; P/O. D. Williams, no address.

Sgt. J. T. Gill, Moorside (Corbar?), Sheffield; Sgt. F. Lindsay, Wallasey, Cheshire; Sgt. K. Sarrow, Basingstoke, Hants; Sgt. C. Butcher, Ramsay, Huntingdonshire; Sgt. M. Stretton, Smethwick, Staffordshire.

Sgt. D. Kane (wounded), address unknown; Sgt. Pead, Halifax, Yorks; Sgt. Alderwick, Staple Hill, Bristol; P/O. Bowman (wounded), address unknown; P/O. Littleston-Scott (wounded), address unknown; Sgt. Castleton, Ditchling Rise, Brighton; Sgt. Walker, Willoughby Crescent, Eastbourne; Sgt. Heritage, Winton, Bournemouth; Sgt. Toynton, Spalding, Lincs; Sgt. Moore, Waterloo, Liverpool, 22; Sgt. Peacock, 61, Leopold Road, Liverpool; Sgt. Steel (E.), Gillingham, Kent; P/O. H. T. Scale, Sinnerton, Victoria, Australia; Sgt. Perrott (wounded), address unknown.

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Royal Air Force

General Duties Branch.

J. O. Alexander is granted a permanent commission as Pilot Officer (April 20, Sen. January 20, 1939).

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation:—Flight Sergeant: (June 20, Sen. May 9) E. E. Sweet. Sergeants: (July 11, Sen. May 9) J. B. P. Hanlon; (July 12, Sen. May 2) F. Squire; (July 26, Sen. May 9) D. H. Davis.

The undermentioned Pilot Officers on probation are confirmed in their appointments:—(May 1) J. J. Le Roux; (June 26) N. Green; (July 10) R. E. Kirkby, A. E. Rimmer, J. H. Young; (July 24) K. Ballas-Andersen, G. R. Holyoke; (July 26) R. A. G. Paramore; (July 28) F. J. Aldridge; (August 1) D. W. Peck; (August 14) S. C. R. Bell.

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant:—(June 19) I. T. B. Rowland, R. H. McConnell, S. P. Coulson; (June 25) W. H. Cliff; (June 28) A. V. Rogers; (July 6) J. H. Wedgwood.

The undermentioned Pilot Officers are promoted to the rank of Flying Officer:—(June 17) J. A. Holmes, H. F. D. Breese, H. A. B. Porteous, W. D. B. Ruth, P. R. S. Filleul, H. V. Matthews, A. J. Payn, H. N. Garbett, T. C. Murray, F. A. Plinston; (June 27) N. H. Svendsen; (June 29) A. G. W. Paul, R. A. Lewis; (July 7) R. W. Wallens; (July 17) J. D. G. Withers; (July 25) N. Tasker, H. R. P. S. Bilbrough.

A.V.M. Sir P. H. L. Playfair, K.B.E., C.B., C.V.O., M.C., is granted the acting rank of Air Marshal (August 5).

Air Comdre. C. W. Nutting, O.B.E., D.S.C., is granted the acting rank of Air Vice-Marshal (August 1).

Air Comdre. A. J. Capel, D.S.O., D.F.C., relinquishes the acting rank of Air Vice-Marshal (June 27).

Air Chief Marshal Sir C. S. Burnett, K.C.B., C.B.E., D.S.O., is seconded for special duty (January 19).

Wing Cdr. G. S. Hodson is seconded for special duty (April 6).

The undermentioned are transferred to the Technical Branch (April 24):—Wing Commanders: R. D. Starley, M.C. Squadron Leaders: F. E. Stokes, R. G. Stone, G. E. Watt, R. J. Carvell (since promoted).

P/O. on probation K. W. Godfrey is transferred to the Administrative and Special Duties Branch (July 19).

Wing Cdr. G. G. Walker, M.C., is placed on the retired list (August 15).

P/O. D. J. M. Cotton Minchin (2nd Bt., Cameronians) relinquishes his temporary commission on return to Army duty (June 13).

The notification in the *Gazette* of July 23 concerning P/O. on probation W. McC. Osborne is cancelled.

Erratum.

In the *Gazette* of July 23 notification concerning Sgt. L. D. Wilson (44307) should have appeared under the heading "R.A.F." instead of "R.A.F.V.R.," and his personal number is as now stated.

Technical Branch.

The undermentioned are granted commissions for the duration of hostilities as Flying Officers on probation:—Warrant Officers: (July 4, Sen. May 9) R. S. Bloye; (July 30, Sen. May 9) C. O. Cook.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation:—Warrant Officers: (July 19, Sen. July 3) A. E. A. MacDonald, W. H. Westgate. Flight Sergeants: (June 25, Sen. May 16) L. G. Leech; (July 17, Sen. May 16) C. J. Fox, H. A. P. Watkins; (July 21, Sen. July 3) W. E. Sully, A.F.M.; (July 22, Sen. May 16) A. W. S. Brown; (July 31, Sen. May 16) R. H. Allen. Sergeants: (July 18, Sen. May 16) C. Aldridge; (July 20, Sen. May 30) H. C. J. L. Connelly.

Sgt. H. Faulkner is granted a commission for the duration of hostilities as Act. Pilot Officer on probation (July 31, Sen. June 20).

Balloon Branch.

P/O. A. J. Jones is transferred to the Technical Branch (July 25).

Administrative and Special Duties Branch.

The undermentioned are granted commissions for the duration of hostilities as Flying Officers on probation:—Warrant Officers: (May 18, Sen. March 7) B. J. Skinner; (July 22, Sen. June 20) M. Buckley; (July 24, Sen. July 15) T. Hatcher; (August 1, Sen. July 15) L. G. Markwick.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation:—Warrant Officer: (July 24, Sen. July 15) N. C. Jacobs. Flight Sergeants: (July 26, Sen. July 1) V. C. Ewens; (July 26, Sen. July 10) W. C. Armstrong; (July 30, Sen. July 3) W. A. Thorpe; (July 30, Sen. July 12) D. J. B. Mann; (July 31, Sen. July 12) T. K. Fitt; (August 2, Sen. July 12) E. E. Overington. Sergeants: (July 25, Sen. July 12) A. R. Towers; (July 29, Sen. July 3) J. T. Main, J. G. Portlock.

F/O. on probation A. Maddison is transferred to the Balloon Branch (May 17).

Equipment Branch.

The undermentioned are granted commissions for the duration of hostilities as Flying Officers on probation:—Warrant Officers: (June 22, Sen. February 29) J. E. Ward; (July 11, Sen. May 2) S. W. Geer, M.M.

Flt. Sgt. T. E. Ekins is granted a commission for the duration of hostilities as Pilot Officer on probation (July 22, Sen. May 2).

The undermentioned Pilot Officers on probation are confirmed in their appointments (May 1): G. W. Coker, D. P. Matthews.

The undermentioned Pilot Officers are promoted to the rank of Flying Officer:—(July 17) B. Armiger, A. E. Jackson, M. G. Teale, D. A. De S. Young-James; (July 24) P. Atkinson; (July 31) G. W. Coker, D. P. Matthews, W. J. Waugh.

Group Capt. B. W. M. Williams is placed on the retired list on account of ill-health (August 13).

Accountant Branch.

W/O. F. C. Harvey is granted a commission for the duration of hostilities as Flying Officer on probation (July 23, Sen. April 18).

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation:—Warrant Officers: (August 1, Sen. July 26) W. A. Crampton; (August 5, Sen. July 26) F. J. Fox. Flight Sergeants: (July 27, Sen. June 6) M. J. Toby.

P/O. on probation A. Lees is confirmed in his appointment April 17 and promoted to the rank of Flying Officer (June 1).

The undermentioned Pilot Officers on probation are confirmed in their appointments June 10 and promoted to the rank of Flying Officer (July 31):—R. V. Carroll, M. M. Gardham, E. M. Greenwood, P. R. Grey, C. E. Harrison, L. R. Pentelow, L. Royle, R. H. Simpson.

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant (June 12):—K. M. Crick, S. M. Macildowie, P. W. Hill, P. N. Isaac.

The undermentioned Pilot Officers are promoted to the rank of Flying Officer (July 31):—R. A. Webster, G. E. White.

Medical Branch.

W/O. H. Fletcher is granted a commission for the duration of hostilities as Qms. and F/O. on probation (August 1, Sen. June 20).

F/O. I. H. Barclay, M.B., B.S., is promoted to the rank of Flight Lieutenant (August 1, Sen. August 1, 1939).

(Left) Air Comdre C. W. Nutting, O.B.E., D.S.C., who has been appointed Acting Air Vice-Marshal.

(Right) A.V.M. Sir P. H. L. Playfair, K.B.E., C.B., C.V.O., M.C., who has been granted the acting rank of Air Marshal.

SERVICE AVIATION (CONTINUED)

The undermentioned are appointed as Medical Officers with the relative rank of Flying Officer (July 30):—Mrs. E. V. Butler Jones, M.R.C.S., L.R.C.P.; Miss K. Byrt, M.B., Ch.B.; Miss A. C. Gillan, M.B., Ch.B.

Commissioned Balloon Officer.

F/O. on probation John McCallum is transferred to the Balloon Branch (April 19).

Royal Air Force Reserve

RESERVE OF AIR FORCE OFFICERS.

General Duties Branch.

F/O. H. Perring is transferred to the Technical Branch (April 24). (Substituted for notification in *Gazette* of July 2.)

The undermentioned are transferred to the Administrative and Special Duties Branch:—(August 9) F/O. G. M. Pitts-Tucker; (August 12) Flt. Lt. P. R. Stroud.

Notification in the *Gazette* of May 28 concerning F/O. H. Perring is cancelled.

ROYAL AIR FORCE VOLUNTEER RESERVE.

General Duties Branch.

The undermentioned are granted commissions for the duration of hostilities in the ranks stated:—Air Commodore: (March 21) C. W. Meredith. Squadron Leader: (March 21) D. C. Dunlop. Flight Lieutenants: (March 21) J. Davison, D. D. Lonemore. Pilot Officers on probation: (April 10) S. B. Cliff; (July 8) K. Shenstone; (July 15) S. G. Giles; (July 29) J. J. Stevens. Sergeants: (June 2) M. O. Davenport; (June 9) R. N. Hunt; (June 15) P. J. Vincent, C. D. Watson, W. L. Watson; (June 16) E. J. Stevens; (June 18) E. E. Males, W. L. B. Walker; (June 29) S. G. Collier, R. F. Trim; (July 13, Sen. July 11) W. P. Carroll, E. E. G. Crump, J. S. H. Lupton, N. J. Wheeler; (July 23, Sen. May 2) C. H. Debenham, R. S. Easby; (July 27, Sen. July 21) D. F. Mackenzie, J. P. Meadows, J. Morgan, G. F. Shaw, E. C. Teddar; (July 27) P. W. Herbert, H. T. Hill, D. M. Howorth, J. F. B. Pomeroy, H. R. Puplett, D. W. Wakeford, F. K. Webster, A. K. S. McCurdy, C. A. Barrett, P. Kennett, M. T. Whinney, A. Mathieson, G. Henoq, R. V. Keeling, J. K. Haviland, D. N. Hookway, J. Lawson-Brown, R. A. Clough, P. J. Darke, E. D. Dear, K. A. Faulkner, N. B. Freeman, S. J. Jacobi, R. F. W. Johnson, J. A. Keard, R. O. Lane, A. G. McQueen, H. M. March, J. P. Rowntree, J. S. Sams, R. McDougall, A. MacD. Melville, E. S. Aldous, W. Spooner, J. G. Woollatt, A. R. Head, H. Paterson, D. E. J. Saint, P. J. Strong, J. G. G. Walkington, J. H. Wetherly. Corporals: (June 24, Sen. May 9) J. R. Juleff, R. L. Lamb, W. D. Wiseman. Leading Aircraftmen: (June 16) A. W. Martin; (July 14) W. D. Barrett, J. Du V. Broughton, R. W. Fastnedge, H. V. T. Helmore, L. A. E. Osbon, A. G. St. J. Ross, D. R. E. Smith; (July 28) K. J. Lawson, L. F. Middleton, M. H. Nisbet, R. C. Thomas, N. A. Sadler, R. Taylor, A. Bleakley, J. A. Brockbank, N. A. Knight, P. Moody, A. F. S. Winder.

K. G. Greenacre is granted a commission for duration of hostilities as Pilot Officer on probation (May 27). (Substituted for notification in *Gazette* of June 18.)

Sgt. W. E. Nixon is granted a commission for the duration of hostilities as Pilot Officer on probation (July 6). (Substituted for notification in *Gazette* of July 23.)

The undermentioned Sergeants are granted commissions for the duration of hostilities as Pilot Officers on probation (July 6): W. H. H. Holland, J. B. Linton, N. F. Waters-Webb. (Substituted for notification in the *Gazette* of July 30.)

The undermentioned are granted commissions for the duration of hostilities as Act. Pilot Officers on probation: (March 6) J. O. Hedley; (June 25) H. W. J. Hooper. (Substituted for notifications in the *Gazettes* of July 16 and July 23): (July 19) E. L. Hartman; (July 20) B. E. L. Odhams; (July 22) W. J. K. Gladwell, R. W. Green, P. Lane; (July 23) J. Edmond; (July 24) P. J. Krdd.

The undermentioned are transferred to the Administrative and Special Duties Branch: (July 1) P/O. P. A. Towsey; (August 10) P/O. on probation G. W. Spiers.

The commissions of the undermentioned are terminated on cessation of duty: (July 18) P/O. on probation N. E. J. Linnett.

Technical Branch.

W/O. H. L. Secker is granted a commission for the duration of hostilities as Flying Officer on probation (July 30, Sen. March 21).

A/C.1. T. J. Norton is granted a commission for the duration of hostilities as Pilot Officer on probation (July 29, Sen. May 30).

Balloon Branch.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation: Sgts.: (July 8, Sen. June 24) A. C. S. Eagles. Cpls.: (July 3, Sen. June 25) M. R. Samuel; (July 13, Sen. June 27) G. T. Armstrong; (July 23, Sen. June 24) R. R. Lloyd-Williams; (July 23, Sen. July 17) D. B. Weldon, R. O. Buchanan; (July 23, Sen. July 18) W. O. Rainforth, C. Norton. A/C.1.: (July 3, Sen. June 25) R. A. Dawson, J. H. L. Innes, C. H. T. Newbronner, T. C. Warren; (July 10, Sen. June 27) D. R. Auld; (July 21, Sen. July 17) J. H. Darville, F. H. Floate; (July 23, Sen. July 17) A. S. Bates; (July 24, Sen. July 18) G. H. Pittam. A/C.2.: (July 23, Sen. July 17) D. C. Gorst, L. C. Lovell.

Administrative and Special Duties Branch.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation:—(May 22nd) T. Capel; (June 13th) A. F. Howgate; (June 26th) E. G. J. Byrne; (June 27th) R. Chaffer, J. G. Cook, R. S. Lambery, A. W. MacLeod, W. J. Tesseyman, H. W. Wood; (June 28th) R. Croft, J. J. Fairbairn, H. G. R. Thomas, F. Wells; (June 29th) E. R. Evans, W. Ferguson, J. P. Wright; (June 30th) L. J. Lumby; (July 2nd) J. W. Crouch, G. F. E. Rapson, C. Tysoe-Smith; (July 3rd) A. Midgley-Carver; (July 4th) C. E. Dersc, H. R. Jones; (July 5th) C. E. Browning, D.S.O., E. A. Richards, H. J. Sketch; (July 6th) H. O. C. Boret, F. J. Trumble; (July 8th) W. Biddle, H. P. White; (July 9th) W. H. C. Coates, M.C., W. B. Williams; (July 10th) G. B. Fry, T. Jenner; (July 12th) C. H. Wilton; (July 14th) B. E. Bishop, J. W. Gossage; (July 16th) G. L. Watson; (July 17th) E. Colmer; (July 18th) G. S. Baker, A. O. Bishop, R. L. W. Rons; (July 19th) M. H. D. Cockayne, H. Collison, F. W. Hollingsworth, A. Willson; (July 20th) C. S. H. Robarts; (July 22nd) W. M. Alpine, A. Campbell, T. W. Collins, F. A. L. De Gruchy, B. B. Gillis, P. Gurrey, G. E. Harris, M. R. N. Jennings, H. Quinlan; (July 23rd) J. V. Cook, J. Fleming, C. C. Marlowe; (July 24th) G. S. Brook, J. Casselis, N. J. T. Holland, T. U. Liddle; (July 25th) A. G. Blunn, C. A. Briggs, T. Fowler, V. W. Huntington, R. J. H. Melhuish; (July 26th) S. E. Legard, Sir F. Nelson, A. D. Nunweek, D. H. Phillips, F. H. Sennock, W. White; (July 27th) D. Davis, A. M. Dawson, T. W. H. Gailey, S. H. Granville Smith, E. B. Macartney; (July 28th) G. K. Green, C. W. Nesbitt, J. Ratcliffe-Springall; (July 29th) R. Beard, P. H. B. Burgoyne, M. E. Faithfull, S. N. Freedman, M. H. B. Gilmour, J. F. Ginnett, H. C. Greene, Sir A. A. St. L. Lee Guinness, Bt., F. M. H. Heanley, J. O. T. Howard, R. P. S. Hubbard, E. W. Hutchings, H. H. Keen, H. L. Mabbott, D. G. Moore, F. T. Parr, A. Phillips, V. Purvis, G. L. Reckitt, F. S. Russell, D.S.O., D.F.C., H. B. I. Schultess-Young, S. T. B. Smith, R. A. Syrett, The Hon. R. M. Watson, T. R. Williams; (July 30th) G. Alchin, A.F.C., W. B. Edwards, V. De M. C. Hewetson, C. A. Male; (July 31st) J. T. Crawshaw, L. H. Fletcher, J. R. Lofthouse, H. G. Phillips, K. R. Russell, R. S. Searle, H. I. Willis; (Aug. 1st) S. H. J. Bates, R. Bell, C. H. Butler, D.S.O., D.S.C., H. W. C. Davies, M. B. H. Dickinson, A. F. Falconer, N. D. Lansdown, C. W. Measor, A. Mac Nicol, A. Round, H. J. T. Soper, A. L. Swinton; (Aug. 2nd) S. Beecroft, G. D. Berry, F. B. Lane, W. T. Young; (Aug. 3rd) E. R. Milner; (Aug. 13th) M. Williams. Sergeant: (Aug. 2nd, Sen. July 24th) W. S. Brundish. Corporal: (July 18th, Sen. June 20th) J. W. Swain. Leading Aircraftmen (July 26th, Sen. June 20th) J. V. P. Henniker Heaton; (July 29th, Sen. May 30th) K. W. Edwards.

S. H. Bonser is granted a commission as Pilot Officer on probation, Aug. 28th, 1939. (Substituted for notification in *Gazette* of March 5th).

A/C.1 A. D. Snowden is granted a commission for the duration of hostilities as Acting Pilot Officer on probation, July 20th, sen. June 25th.

The undermentioned Pilot Officers on probation are transferred to the Balloon Branch:—(March 27th) A. L. Grice, M. A. V. Russell; (May 12th) T. R. H. Kane, S. Jackson.

Flt. Lt. F. C. M. Evans relinquishes his commission on appointment to a commission in the R.N.V.R., Aug. 12th.

P/O on probation C. E. Dease, O.B.E., relinquishes his commission on account of ill-health, Aug. 12th.

The undermentioned resign their commissions, Aug. 9th:—Flying Officer: T. G. Simnson. Pilot Officers on probation: B. O. Davis, E. G. Jones, R. Williams.

Equipment Branch.

P/O. P. H. Thomson is promoted to the rank of Flying Officer (Nov. 24th, 1939).

Accountant Branch.

Flt. Lt. (temp. Sqn. Ldr.) J. D. Cameron, O.B.E., relinquishes his commission on account of ill-health (Aug. 26th).

Medical Branch.

The undermentioned are granted commissions for the duration of hostilities:—Flight Lieutenants: (July 30th) G. K. Burr, M.B., Ch.B., D.O.M.S., R. W. B. Ellis, M.D., B.Chir., F.R.C.P., J. Hughes, B.Chir., F.R.C.S., L.R.C.P. W. G. Hutton, M.R.C.S., L.R.C.P., D.O.M.S. Flying Officers: (July 16th) C. A. Dowding, M.B., B.Chir., M.R.C.S., L.R.C.P.; (July 30th) T. Akroyd, M.B., Ch.B., L.R.C.P. and S., L.R.F.P. and S., G. B. Barbour, M.B., B.Ch., L.M.S.S.A., R. F. T. Finn, L.M.S.S.A., B. Flacks, M.B., Ch.B., M.R.C.S., L.R.C.P., G. R. Green, L.M.S.S.A., R. D. Kennedy, M.B., B.Chir., M.R.C.S., L.R.C.P., R. O'Meara, M.R.C.S., L.R.C.P., J. V. O'Sullivan, M.B., B.Ch., J. N. Pattinson, M.B., B.Chir., C. W. R. Rayne-Davis, B.M., B.Ch., M.R.C.S., L.R.C.P., H. W. Smithies, L.M.S.S.A., J. Taylor, M.B., B.Ch., N. J. W. Thompson, M.B., B.Ch., D.P.H., A. W. Woodruff, M.B., B.S.

The commission of F/O. R. Macpherson, M.R.C.S., L.R.C.P., is antedated to Feb. 1st, and he ceases to be seconded to St. Bartholomew's Hospital (Aug. 1st).

Dental Branch.

The undermentioned are granted commissions for the duration of hostilities as Flying Officers:—(July 30th) J. F. Batsford, L.D.S., A. N. Butler, L.D.S., C. G. Palmer, L.D.S., K. G. Sharvill, L.D.S., O. S. Ralston, L.D.S.

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant:—(July 18th) R. A. E. Williams, L.D.S., P. D. Wharton, L.D.S.

Chaplains Branch.

The undermentioned are granted commissions for the duration of hostilities with the relative rank of Squadron Leader:—(July 29th) The Rev. H. E. W. Turner, B.A.; (Aug. 1st) The Rev. G. H. Crick, B.A., The Rev. L. Watson, M.A.; (Aug. 2nd) The Rev. T. H. Ellis.

The Rev. H. W. Pinchbeck resigns his commission (July 28th).

Auxiliary Air Force

General Duties Branch.

The undermentioned are transferred to the Administrative and Special Duties Branch, March 27th. Flight Lieutenants: G. C. Maxwell, M.C., D.F.C., A.F.C., J. E. Redding. Flying Officers: R. S. Kemp-Scriven, R. E. Baty, M.C., G. F. Couzens, F. Thurlow. Pilot Officers: C. H. Gadney, H. R. F. Yorke, J. Wilson, M.C., H. Eltherington, J. P. Mills, J. M. S. Hogg, S. S. Wheeler.

Accountant Branch.

P/O. R. Grimshaw is promoted to the rank of Flying Officer (July 23rd).

Balloon Branch.

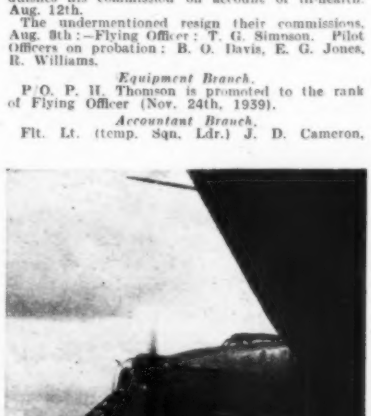
The officers shown on pages 360 to 370 of the Air Force List for June, except those mentioned below, are transferred to the Balloon Branch (March 27).—Flight Lieutenants: B. G. M. Nixon, D. C. H. Ferguson, G. C. Maxwell, M.C., D.F.C., A.F.C., J. E. Redding. Flying Officers: R. P. Cathrow, R. Musgrave, C. O. Hinks, A. T. Daw, R. S. Kemp-Scriven, R. Elphinstone Baty, M.C., G. F. Couzens, F. Thurlow. Pilot Officers: C. H. Gadney, H. R. F. Yorke, J. Wilson, M.C., H. Eltherington, J. P. Mills, J. M. S. Hogg, S. S. Wheeler, B. Allerton. Pilot Officers (on probation): G. P. M. Davis, J. C. E. Luard, A. L. Cates, W. J. Breen, P. Caddy, H. W. Cousins, R. J. Debenham, J. D. Frame, A. F. J. H. Keen, D. A. Kingston, L. G. W. Mallows, L. Monnickendum, E. W. Moses, E. S. Reding, E. G. Rhodes, B. L. Salmon, I. I. Simons, H. Thomas, B. I. Ward, I. R. Wearmouth, G. A. Woodwark, G. F. W. Zimmer, J. N. K. Whitford.

Women's Auxiliary Air Force

The undermentioned are appointed Assistant Section Officers on the dates stated:—(May 22nd) Sgt. Miss A. N. Philps, Sgt. Miss V. Russell; (May 29th) A/CW.2 Miss C. A. Debenham, A/CW.2 Miss M. F. Hothersall, A/CW.2 Miss M. G. W. Laws, A/CW.2 Miss M. E. Rainey, Sgt. Miss M. L. Strong, Sgt. Mrs. B. M. Thomson; (Aug. 10th) A/CW.1 Miss E. M. Aves, Sgt. Mrs. L. D. C. Bell, A/CW.1 Mrs. M. L. Bernard, A/CW.1 Miss P. M. Braithwaite, A/CW.1 Miss G. E. Buffey, Cpl. Miss E. M. W. Crocker, A/CW.1 Miss B. Davies, A/CW.1 Miss E. P. Davies, Sen. Sgt. Mrs. O. P. Davies, A/CW.1 Miss P. M. S. Davis, A/CW.2 Miss L. G. Dick, A/CW.1 Miss G. Dunlop, A/CW.1 Miss G. B. Dunstone, Cpl. Mrs. E. D. Durling, Cpl. Miss D. F. Farr, A/CW.1 Miss M. G. M. Fernbank, A/CW.1 Miss E. A. Ferrie, A/CW.1 Miss V. G. Fortescue, A/CW.1 Miss J. M. Fraser, A/CW.2 Miss O. M. Gledhill, Cpl. Miss D. F. Glover, A/CW.1 Mrs. M. B. Goodman, Cpl. Miss G. A. Hide, Sgt. Miss E. M. S. Hughes, A/CW.1 Miss D. H. McFarlan, A/CW.2 Miss F. E. G. Macgregor; Cpl. Miss E. C. G. Miller, A/CW.1 Miss V. P. Mortimer, A/CW.1 Miss D. R. Pickford, Cpl. Mrs. E. B. Sara, Sgt. Miss D. E. Simon, Cpl. Miss M. W. Simpson, A/CW.1 Miss J. M. Sowerby, A/CW.2 Miss I. M. Stannard, A/CW.1 Miss A. W. Taylor, A/CW.1 Miss M. Truter, Sgt. Miss D. M. Whiddett, A/CW.1 Mrs. G. G. White, A/CW.1 Miss S. D. Workman; (Aug. 11th) Sgt. Miss S. C. Taylor; (Aug. 12th) Sgt. Miss M. F. Arkell, A/CW 1 Miss T. A. Bayley, A/CW.1 Mrs. I. M. Carroll, Cpl. Miss J. Leggat.

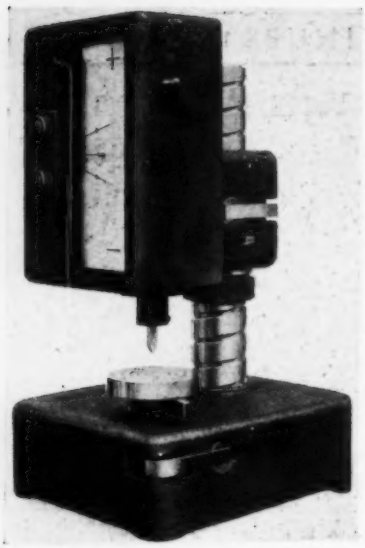
Erratum.

In the *London Gazette* of Aug. 6th, *for* 884851 Aircraftwoman 1st Class Miss Mina Winifred Musselwhite (920) *read* 884851 Aircraftwoman 1st Class Miss Mima Winifred Musselwhite (920).



TURIN TOURER: The A. W. Whitley IV has been used for the recent raids on aircraft factories in Italy.

THE INDUSTRY



The Sigma Comparator showing clearly the throat depth and graduation scale.

Going To It

AN example of wholehearted adoption of the slogan "Go To It" comes from employees of Bell's Asbestos and Engineering, Ltd., where the whole of the clerical staff, consisting of men and women of varying ages, are sacrificing a good deal of their spare time in order to serve as factory hands and help in increasing the output, which is required for war purposes.

All the clerical staff volunteered for a course of training to fit them for the general work in the factory, which, among other things, produces R.A.F. asbestos suits and various A.R.P. fire-fighting apparatus. The training was provided between the hours of 7 and 9 a.m. each week-day, which was before the usual office hours commenced.

As soon as the clerks, typists and accountants are capable of the work, arrangements are made for them to carry on as factory hands every other Saturday afternoon and Sunday. Their rates of pay for the self-imposed tasks are the same as those prevailing for the other factory hands.

Quids Pro Quo

AVIATION CORPORATES, LTD., in the person of Mr. J. H. Millar and as agent of the Commonwealth Eng. Corp., of Dayton, Ohio, would be glad to conduct negotiations between interested parties for the sale of patent licences and rights to manufacture in the U.S.A. This is of particular interest in these days when income from foreign sources is so necessary for our war effort.

C.E.C. also offer to arrange for the exchange of patent licences and technical information. For instance, American companies are continually taking out foreign patents while European companies are securing American patents. It often happens that it is not profitable for both companies to manufacture or sell in the country of the other, thereupon each company exchanges its patents and technical information with the other and both strengthen their domestic positions by patents within their own spheres of influence. It has been found that these cross licence arrangements are profitable and successful. American patents owned by foreign companies therefore become profitable and valuable to them from royalties, exchange of technical information from American companies, reciprocal sales arrangements and protection of sales of special machinery in the United States as well as increased business from the United States patent rights on American invention in foreign countries.

The address of Aviation Corporates, Ltd., is 50, Pall Mall, London, W.1.

Sigma Comparator

A NEW comparator, manufactured by the Sigma Manufacturing Company, Letchworth, and marketed by E. H. Jones (Machine Tools), Ltd., is now in production and fairly early deliveries may be expected.

The Sigma comparator enables rapid and accurate inspection to be made of interchangeable, mass-produced components. It is designed so as to fulfil the most exacting requirements of inspection apparatus in that it allows of speedy handling of the work, a clear indication of the result of the test and a constant view of the component under check.

The complete range of the instrument is 0.006in. and the graduation of the scale is arranged to check within tolerances of ± 0.003in., the magnification being 1,000 to 1. The throat depth of the instrument is 3¾in. and work up to 4in. high can be checked; where required an extended column can be supplied to check larger work.

E. H. Jones' address is Edgware Road, The Hyde, Hendon, London, N.W.9.

Air Lines

COMPRESSED air as a motive power has many applications in the aircraft industry. It is used not only for operating tools such as drills and riveters, but also it has been fitted to blow guns and blow valves in the machine shop. In aircraft itself compressed air is used as a motive power.

In the factory the Schrader quick-acting coupler provides a flexibility almost equal to that of electricity. This automatic socket connection is fitted to the airline at any convenient point so that the tools can be plugged in where they are wanted. When not in use the coupler makes an air-tight seal and does not impede the supply of air to other points.

Similarly, Schrader blow guns and industrial control valves are widely used on presses and automatics for discharging completed work, or for clearing dust, swarf and scrap. The simple addition of pneumatic power can greatly increase the machine output which is so essential to-day. As an example we may quote the fitting of a blow valve to a drill press used for drilling three holes in a brass fitting. The air jet operated by a blow valve which is in turn connected to the airline by a quick-acting coupler enabled the rate of drilling to be increased from 80 to 200 per hour.

The Schrader valve, well known to every motorist, is used exclusively for tail and landing wheels on all British aircraft. Research has been necessary to evolve special valves and fittings for the large tyres and air-operated brakes used on the heaviest types of bombers. The cubic capacity of these tyres called for a greater speed of inflation and deflation. Schrader were able to solve this problem to the satisfaction of both the tyre manufacturers and the Air Ministry.

From brakes to guns seems a far cry since they have such divergent applications. However, air-operated multi-gun control on our fighters followed the knowledge gained in the research on air brakes and to-day plays its very full share in our air effectiveness.

Timken Presentation

MR. F. J. PASCOE, Director, British Timken, Ltd., made a presentation on August 20 on behalf of the Directors and staff to Mr. J. H. Boden, who has retired owing to ill-health.

Mr. Boden, who is a brother of the late Mr. Oliver Boden, of Nuffield group fame, has been with the British Timken organisation in Birmingham for 25 years. He was the company's first industrial sales representatives and as such became well known to engineers all over the country.

British and S.A.E. Nickel Steels

A SMALL booklet setting out the relationships existing between British and S.A.E. nickel alloy steels has been produced by The Mond Nickel Company. In one table is given the S.A.E. specification numbers which are equivalent in properties to the various British nickel steels, while another table gives the corresponding chemical compositions. The S.A.E. numbering system is explained and tempering information given on some of the nickel, chromium and molybdenum steels.

Copies of this useful book of 15 pages may be obtained on application to the company at 2, Upper Brighton Road, Surbiton, Surrey.

AERONAUTICAL PATENT SPECIFICATIONS

33200. MARTIN, J. and MARTIN-BAKER AIRCRAFT CO., LTD. Working platform for use on the wings of aeroplanes (521,354).

33428. GRAVINER MANUFACTURING CO., LTD., SAUMOND, H. M., and MATHISEN, A. Gravity operated electric switches and their use in automatic fire-extinguishing systems upon aircraft and the like (521,374).
1939.

22201. SPERRY GYROSCOPE CO., INC., and STEVENS, A. H. (SPERRY GYROSCOPE CO., INC.). Flight-indicating devices for aircraft (521,184).
(*Published June 20th*, 1940.)
1938

33510. SHAW, H. D. Aircraft-wing construction (521,414).

34092. CLEVELAND, F. J. (Boeing Aircraft Co.). Pressure-control system for use in connection with aircraft pressure cabins (521,623).

34272. JANECEK, F., and JANECEK, F. K., Armour-piercing projectiles (521,633).

34507. GENERAL AIRCRAFT, LTD., WILLIAMS, D. L. H. and CROCOMBE, F. F. Landing gear arrangement of aircraft (521,634).
(*Published June 27th*, 1940.)
1938

25514. MEFINA SOC. ANON. Percussion fuzes for bombs (521,879).

29177. BRISTOL AEROPLANE CO., LTD., and FRISE, L. G. Gun turrets for aircraft (521,704).

34475. BRITISH THOMSON-HOUSTON CO., LTD., ISAAC, A. C. T., and SCOTT, W. J. Means for enabling aeroplanes to land in the dark (521,852).

34917. BECHEREAU, L., and AVIONS KELLNER-BECHEREAU SOC. ANON. Construction of aeroplanes (521,881).